THE DIVINING-ROD*.

BY ROSSITER W. RAYMOND.

(Concluded from page 472.)

Numerous hydroscopes soon appeared in Italy, and a vigorous discussion of the subject followed. One of the latest celebrated experts of this class was Campetti, who was called to Munich in 1806 for scientific examination. One of the writers of this period, Abbé Amoretti, himself a member of a family containing many hydroscopes, makes the significant assertion that the sensation experienced by the holder of the divining-rod is one of heat or cold. But the name of Amoretti recalls the fact that he was one of those who revived and continued the discussion of "the magic pendulum."

The earliest mention of this apparatus, according to M. Chevreul, is found in the work of Ammianus Marcellinus, the last of the Latin historians, who died A. D. 390. In an obscure passage (lib. xxix, cap. 1), giving the confession of one of the conspirators against the Emperor of the East, this author describes, in the words of the conspirator, the ceremonies adopted by the band to discover the name of the Emperer's predestined successor. Among these was the use of a ring suspended by a fine thread over a disk, around the edge of which, at equal intervals, were the letters of the alphabet. The ring in its oscillations pointed out successively the letters T, H, E, O, whereupon, without further inquiry, all perceived that Theodorous was the one designated by destiny. Father Schott mentions the pendulum in his "Physcia Curiosa" (1662), already alluded to in this paper.

In the latter part of the eighteenth century, and at the beginning of the nineteenth century scientific men were attached to this phenomenon. Albert Fortis (Mémoirs pour Servir à l'Histoire Naturelle et principalment à l'Oryctographie de l'Italie et des pays Adjacents," (1802), Professor Gerboin of Strasburgh ("Recherché Experimentales sur un Nouveau Mode de l'Action Electrique," 1808) and Professor Ritter of Munich (see his report in the Tubingen *Morgenblatt für Gebildete Stände*, No. 26, Jan. 30, 1807), were among the number, as well as the Abbé Charles Amorette, librarian at Milan, to whom I have already alluded. As this mention of the pendulum is in the nature of a digression, though (as will appear) not without pertinence to my main argument, I content myself with an abstract from Ritter's article. He says:

"Take a cube of pyrites, native sulphur or any metal. Size and form are indifferent. We may use, for instance, a gold ring. This body is attached to a piece of thread ¼ to ½ an ell long. This is held pinched between two fingers and suspended vertically, all mechanical movement being hindered. It is best to wet the thread slightly. In this condition the pendulum is held over or close to a vessel full of water, or over any metal, as a piece of money or a plaque of zinc or copper. The pendulum insensibly assumes elliptical oscillations, which form themselves into a circle, becoming more and more regular. On the north pole of the magnet the movement is from left to right; over the south pole, from right to left; over copper or silver, as in the former instance, over zinc or water, as in the latter. * * * Over an orange or an apple, on the side of the stem, the move is the same as over a south pole; on the opposite side, as over the north pole. The same difference in polarity is shown by the two ends of a fresh egg. It shows itself still more strikingly in the different parts of the human body, the head acting upon the pendulum like zinc, the sole of the foot like copper; forehead and eyes, north pole; nose and mouth, south pole; chin like the forehead, and so on with all parts. The palm and the back of the hand act in opposite senses. The pendulum will move over every point of the finger, and even over the fourth or ring finger, but, in that case, in an opposite direction. This finger has also the faculty of arresting or diverting the movement of the pendulum. It needs merely to be placed alone upon the table used in the experiment." So much for the outline of Ritter's statement. He was at this time occupied with Campetti, above mentioned, and naturally he brought together in his thoughts the divining-rod of Campetti with the pendulum of Fortis (Fortis had experimented with it, and it was often called by his name in consequence; but his death in 1803 deprived Ritter of his advice and aid in further tests).

Campetti was a young peasant from the borders of the Laga di Garda who had seen the performances of Penent, Dr. Thouvenel's last *protegé*, and had found himself possessed of similar power. Not only Ritter, but Schelling and Franz Baader examined him. The opinion expressed by Ritter was that the divining-rod is simply a double pendulum, requiring to set it in motion a force greater than those which move the pendulum. Ritter wrote this after consulting with Amoretti, and others, and after he or Amoretti had visited and consulted, at Padua, the great Volta. But Professor Gerboin carried his scientific study of the pendulum to a much greater extent. His book contains, in 356 octavo pages, the records of 253 experiments, and a most elaborate theory of "organo-electric force," in its different qualities—expansive, compressive, passive perturbatory and active perturbatory. The simplest actions of these qualities may be indicated thus, to condense from the Professor's somewhat verbose description:

By virtue of the expansive quality, which resides most abundantly in the thumb and forefinger, a pendulum held between these two is caused to describe with its center of gravity a circle. The compressive quality, belonging characteristically to the middle finger, will not permit this motion, or will stop it—as when a highly-compressive man touches the hand of an expansive man, which is holding the swinging pendulum. Contact ceasing, the movement recommences. The passive perturbatory is a high degree of the expansive, and the active perturbatory is in like manner a powerful compressive. The possessor of the former, if while holding a pendulum he is suitably touched by one of the first or second class, will find the pendulum, if at rest, to start backward, and if in motion already, to reverse its motion. The fourth class is, like the second, negative in its action. Persons exercising either the compressive or the active perturbatory quality cannot cause the pendulum to oscillate; they can only counteract or reverse its oscillations in the hands of others.

Considering that the author goes on to formulate the permutations and combinations of these qualities of force, their relations to the different fingers and to a long list of organic and inorganic bodies, I may be excused from following further his intricate and obscure system. Elaborate as it is, the whole structure is absolutely baseless and constitutes a capital example of what St. Paul denominated "science, falsely so called." Its vast array of worthless experiments are merely so many ciphers in a row with a decinal point instead of a unit at the head. When the distinguished chemist Michel Eugène Chevreul (long the chief of the Gobelin tapestry works and the author of a well-known book on color, as well as other important works) took up the subject in 1812 he was not long in discovering that when the eyes of the oparator were blindfolded, so that neither his will nor his thought could consciously or unconsciously affect the movement of the pendulum, the data, arguments and conclusions of Fortis, Amoretti, Ritter and Gerboine; the organo-electric force, with its qualities, expansive, compressive and perturbatory; the south poles and north poles, the classification of the universe thereby—in short, the entire science, bag and baggage, disappeared.

Gerboine had pronounced the action of the divining-rod to be a case of passive perturbatory. Chevreul, as we shall see, put both the rod and the pendulum in a new category. But before proceeding to state his theory, I will devote a word or two to the evidence presented in our own country. It is safe to say that most of it, like most evidence of the past, is open to the suspicion of at least an alloy of deception. Men who make money out of their reputed skill with the divining-rod, and who could not make as much money or advertise themselves so widely if they claimed only a high degree of skill as prospectors, will almost inevitably ascribe to the rod what is due to other means of inquiry; will explain away failures, exaggerate successes, and not establish or execute or permit really thorough or sincere experiment. The most distinguished expert in this art on the Pacific coast has been repeatedly made ridiculous by the result of test experiments. On one occasion, as I learn from an eye-witness, who also reported the circumstances to the *Mining and Scientific Press*, of San Francisco, this diviner was permitted to inspect a metallurgical laboratory, which always contained a large amount of gold, either in bullion or coin. After this inspection he was brought (blindfold) again into the laboratory, and assured that no coin or bullion had been removed. Under these circumstances he was requested to find the metal with his rod. The coin had all been put in its natural receptacle, the fire-proof safe, and the bullion had been fastened with wire to the under side of a writing table. The operator found neither of them, though the point of his rod was frequently within an inch of thousands of dollars. He had probably suspected a trick and he declared that the gold had been removed. When the bandage was again removed from his eyes and the coin and bullion shown to him, he claimed that his rod had been diverted by the immense amount of treasure in a bank half a block distant. There have also been operators in California claiming to be natural magnets, and not using the rod, but they are not known to have accomplished any better success. One of these natural magnets was employed to trace a lost vein for a mining company at Grass Valley, the mine of which at one time had been the most productive in California. Under his direction the company cut for many hundred feet, at an expense of $30 to $40 per foot, through tough serpentine rock, and found nothing. Not only are these belts of serpentine at Grass Valley well known to be barren in general, but this particular belt was actually exposed in a cross-section, parallel to this expensive underground cross-cut, only ⅛ mile away.

The persons most familiar with the mining districts in the West, declare that in Grass Valley and elsewhere the devining-rod has accomplished nothing of practical value. It was very recently announced by telegraph from Tombstone, Arizona, that a large body of ore had been found at a considerable depth, under a spot indicated by the "hooda-stick" (which, I suppose is some sort of divining-rod) in the hands of a common workman. I need hardly say that such a discovery proves nothing. It would be, of course, presumptious for me, in the absence of information as to persons and circumstances, to criticise this most recent case, but I cannot forbear saying that nothing is more common in the experience of mining superintendents than the discovery of ore-bodies by workmen who have carried for a long time the secret knowledge of their existence. Most frequently it occurs when a mine seems to have been exhausted or at least the superintendent does not know where to look for ore, or finally leases some portion of the ground to miners who, by a good luck that would be surprising if it were not so easily explained, go straightway into a bonanza. It is not always, however, the certain knowledge of the existence of an ore-body observed by workman and kept secret with a view to future profit, which guides these practical explorers. Often it is their great familiarity with the indications of the ground, and sometimes, let me add, the ignorance and pride of the manager himself co-operate with this result, by leading him to pursue some erroneous theory of exploration, and to refuse the advice of practical men. The so-called instinct of Mexican miners for finding ore, exhibited particularly in such irregular formations as those of the quicksilver mines of New Almaden, is indeed, an unconscious practice of an unwritten science.

The scientific explanation of the movement of the divining-rod was given by M. Chevreul, in a letter to M. Ampère, published in 1882 in the *Revue des Deux Mondes*. This letter contained an account of the experiments made by the writer in 1812, more than 20 years before, with the pendulum. Finally, in 1853, M. Chevreul having been appointed by the Academy of Sciences upon a committee to examine a work on the divining-rod, wrote a report on the subject, including the "exploring pendulum" and the then novel wonders of "table-tipping."

This report was published in 1854 under the title "De la Caguette Divinatoire, du Pendule dit Explorateur, et des Tables Tournantes, au Point de Vue de l'Histoire, de la Critique et de la Méthode Expérimentale." It is worthy of notice that this venerable *savant* is still active at the age of 97; only the other day he spoke before the Academy, referring to a paper he had presented to that body, if I remember correctly, 70 years ago!

Chevreul ascribes the movement of the rod, apart from cases of deliberate deception, to minute, unconscious, muscular movements, and these are caused, he thinks, by the imagination or intuitive or unconscious decision or expectation of the operator. An impression that the rod will dip at a certain point, or a wish that it would, or even, in some minds, a fear that it may do so, are all effective causes of the peculiar muscular movement. Stories describing motions of the rod so violent as to strip the bark from it, in spite of the resistance of the holder, do not disprove the above theory. The position of arms, hands and fingers usually prescribed for the holding of the rod, as explained in the beginning of this essay, is one in which it is not easy (though not impossible) to produce by conscious effort the peculiar movement referred to. But it is also one in which skillful effort, if employed, may be easily disguised; and finally, it is one which invites muscular cramps and produces muscular torsions and involuntary movements, not to be resisted successfully without a change of position. Under these circumstances, a man might easily twist the bark from a willow stick, and yet fancy he was trying not to do it.

In concluding this survey of the subject, I shall take a somewhat wider view than M. Chevreul, and my remarks, though based on his theory, should not be received as representing it.

From the mass of testimony, good, bad and indifferent, the following propositions may be safely deduced:

1. The material, consecration, astrological relations and ritual formalities of the rod are entirely irrelevant and indifferent to its efficacy. This disposes at a stroke of nine-tenths of the science which the Middle Ages so laboriously accumulated on the subject.

2. The rod itself is entirely inert unless in the hands of a human operator, and according to the declaration of the most famous experts, such as Aymar, Bleton, Amoretti and many others, and a whole school of diviners who do not use the rod at all, it is merely an index, revealing and magni-

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fying in visible results the peculiar inward sensations of the diviner.

3. The favorite and most convenient form of the rod (λ) is one which promotes involuntary movements and also permits deception.

4. The involuntary minute muscular movements may proceed either from the causes enumerated by Chevreul or from a truly and purely physical sensation. To this I will presently recur.

5. The use of the rod for discovering moral qualities, re-locating missing landmarks, tracing stolen property, prophesying the future, or even (as in the 17th century was the case) settling the orthodoxy of theological dogmas, will not now be seriously defended by any one. They belong to charlatanry and superstition.

6. The agency of demons we may also set aside, as a view outgrown, if not disproved. The pious Jesuit Gaspard Schott (1662), who held this view, was, as we have seen, shaken in his faith, though not convinced, by testimony showing how often the rod failed to act, or gave unreliable indications. He half admits that if Satan were at the bottom of it, it should work better. As an instrument of divination, it is unworthy of the devil! But, it might have been rejoined, that as a means of perplexing and misleading mankind, that distinguished expert could not have improved upon it.

As old Albinus ("Das Entlarvte Idol der Wünschelruthe," 1700) quaintly says:

"Ich achte, dass kein verworrener Ding in der Welt zu finden als das Wünschelruthen-Wesen, denn was Einem recht und tauglich ist, das ist vielen Anderen wieder unrecht und untauglich, dass aus solcher grossen confusion nicht viel Gutes zu präumiren ist." (I ween that no confoundeder thing is to be found in the world than the divining-rod business; for whatsoever is right and fit according to one, the same is wrong and unfit according to others; until there is no good to be presumed out of so great confusion.)

7. The application of the rod to the discovery of metals, coal, buried treasure, etc., is shown abundantly to be chimerical. The rules and methods, as well as the asserted performances, of its professors contradict each other, and innumerable failures and exposures have justly covered with ridicule their pretensions.

8. The transparent humbug of locating wells with the rod, to strike oil at depths of from a hundred to thousands of feet, needs no comment. In this case there are positively no signs by which a given spot can be selected. The experience of neighbors may show a certain area to be probably productive; and within that area a certain line may by inferred, sometimes, to be the line of a productive channel. But if a keen observer, having gone so far, professes to select a point of that line, he is simply betting on his luck, and, as carried on in Pennsylvania, the bet is a safe one for the oil-smeller, who gets a handsome fee if he wins, and loses, in the opposite event, nothing but an hour or two of time.

9. The case is somewhat different with the discovery of springs, and (since ore deposits always have been and often still are the channels of springs) of ore deposits. Here we have much stronger and more abundant evidence in favor of the rod, and here, in my judgment, there is a residuum of scientific value, after making all necessary deductions for exaggeration, self-deception and fraud. Keeping in mind that the rod is merely an index to the minute muscular movement, and that this movement may have a mental or a physical cause, let us consider (putting aside at once all cases of deliberate deception) the following facts:

There is undoubtedly a practical science of discovering mineral deposits and springs. The most skillful prospectors can scarcely explain how they decide upon the place where they dig; and yet, though they are by no means always successful, it is certain that they are more successful than the inexperienced. The books, from Agricola down, give rules and signs; but the practical explorer is unacquainted with the books. He has a science of his own, which affects his mind, without conscious reasoning, by the principles of association and memory. He recognizes in a new locality the tokens that he has become accustomed to associate elsewhere with a rich gulch, or an abundance of pay quartz. Perhaps he never took conscious note of them; yet their recurrence affects his judgment. This practical skill is almost unerring within narrow limits. Under new conditons it breaks down. Some of the most absurdly foolish gold-mining enterprises I have known have been set on foot by old California miners, who, returning to their former homes east of the mountains, have said at once of some ravine or hillside that it was "just the place for gold." In like manner, certain omens and signs from Cornwall have been carried around the world by Cornish miners. But whatever the errors of practical prospectors, the noteworthy point is that in localities with which they are familiar (or in other localities where the conditions are the same) they come swiftly, surely, and without conscious reasoning, to impressions and decisions. A decision of this kind would probably, in a man of suitable nervous organization, affect the muscles already constrained by holding a divining-rod, and the minute muscular movement or inward sensation might be unconscious.

The case is still plainer with regard to the discovery of springs. Everybody knows that Indians in our desert West can find water where most white men cannot, and the experienced frontiersman has learned the art from the savages. The conformation of the surface, the tracks of animals—above all the presence or absence of certain plants—are his guides. In regions where the finding of water within a few feet of the surface is a question of life or death, it becomes a science very rapidly. The location of artesian wells is a different matter. Science will do that in a general way; but science will not determine a difference between one spot and another, 10 or 20 ft. away, the geological and topographical conditions being alike in both, and the selection of one of two such points as better than the other for a deep well is purely a piece of imagination or deceit. It must be remembered, however, that the diviner has in such a case an easy task. If possessed of sufficient practical judgment to decide that a certain area or line would probably be suitable for boring, he is pretty sure to be safe in selecting any point of it. But this, it will be seen, is very different from the unconscious skill which points out in the dry *arroyo* the very spot where water will be found in half an hour's digging.

In abundantly-watered regions like New England, it is perfectly well known that the springs follow, under or through the soil and above the bed-rock, more or less defined channels. A well may be dug at one point without success, and a subsequent attempt a few yards away may be successful. The superficial signs of the water-courses are often subtle, and they are little studied by the inhabitants in general. It is not necessary that a farmer, who will want to locate a well once in his lifetime, should know the signs of water as a ranchman or *vaquero* must know them. Hence, men who are keen observers (in many instances, finding profit in the business) get impressions, amounting to a local science, of the "lay" of the rocks, the general courses of the springs, the differences in surface vegetation, the earlier or later greenness of grass, the presence of particular grasses and shrubs, the ascent of local vapors at sunrise, the behavior of frosts—in short, a hundred minute tokens which betray the presence, even at considerable depth, of a water-channel, and the point at which it comes nearest the surface. The unconscious judgment of such an expert may decide upon a given spot over which he walks, and while he could undoubtedly come to this conclusion without having a rod in his hand, I am willing to admit seriously that the rod may help him make up his mind by emphasizing for him his own slightest tendency to a decision. It should be remembered here that even Bleton, the greatest of all the hydroscopists, generally used to go (if permitted) many times over a piece of land before finally locating a well, and often disregarded the first intimation of the rod. In other words, unless he felt sure, every time he crossed a given spot, that it was a good place to dig, he did not rely upon his first sensation or impression. Moreover, neither he nor any other hydroscope has ever accurately divided, except on an occasional lucky guess, either the distance from the surface or the quantity of a subterranean spring. Yet a very large spring, or one very near the surface, appears to have had, usually, a relatively greater influence upon hydroscopes.

This brings me to the final inquiry, whether there may not be, apart from unconscious skill or judgment, a purely physical effect produced by a subterranean spring upon a person walking over it. Electrical theories on this point were only possible in the days when the laws of electricity were little understood. We know now that the earth is a vast conductor, and that the tension of its currents is consequently so low as to be reckoned as the zero of the electricians' scale; hence, that no perceptible electrical current can leave a particular bit of the earth to pass through a human body and return. For this purpose analogies between rock contacts or fissure veins and the voltaic pile are inapplicable.

But the effects of moisture and emperature upon the nerves are often striking; and here, I think, is a matter which writers on the divining-rod have generally overlooked. The distance at which animals will "scent water" is very great. Their faculty is supposed to consist in great sensitiveness to temperature and moisture. The quickness with which some people "catch cold" on the slightest exposure to dampness—particularly of the soles of the feet—is also a familiar phenomenon. Now, it is curious that among the most puzzling of the well authenticated accounts of the divining-rod are related instances in which women unacquainted with its use, and not expecting it to work in their hands, have found it to dip, without their conscious help, over spots previously or subsequently shown to contain springs.

Here I would recall the remark of Amoretti—that the sensation of the diviner is one of heat or cold. These two are not easily distinguishable when minute and transient. What we call a chill includes both. It is not probable that a single unconscious chill may be the physical result to certain sensitive persons of walking over a spring of water or belt of rock or soil kept by running water cooler than the adjacent rock or soil, or a spot of surface made by the same cause damper that the surrounding surface? That these causes exist, is beyond doubt. Thermometrical measurements have not been made; but the way in which grass grows and snow lies and frost settles and vapors rise over springs is due to the temperature and moisture of the ground in such places. Goethe, in one of his novels ("Die Whalverwandschaften," I believe), describes a lady as seized with a sudden chill upon a spot where subsequently the outcrop of a coal bed is discovered. The incident is introduced without attempt at scientific explanation, and apparently to convey to the reader a vivid conception of the lady's extreme delicacy of temperament. I infer from it that such cases were known to the great philosopher, and that he believed such supersensitiveness to be in some way connected with the performances of diviners.

To this, then, the rod of Moses, of Jacob, of Mercury, of Circe, of Valentine, of Beausoliel, of Vallemont, of Aymar, of Bleton, of Pennet, of Campitti—even of Mr. Latimer—has come at last. In itself it is nothing. Its claims to virtues derived from deity, from satan, from affinities and sympathies, from corpuscular effluvia, from electrical currents, from passive pertubatory qualities of organo-electric force, are hopelessly collapsed and discarded. A whole library of learned rubbish about it which remains to us furnishes jargon for charlatans, marvelous tales for fools and amusement for antiquarians; otherwise it is only fit to constitute part of Mr. Caxton's "History of Human Error." And the sphere of the divining-rod has shrunk with its authority. In one department after another it has been found useless. Even in the one application left to it with any show of reason it is nothing unless held in skillful hands, and whoever has the skill may dispense with the rod. It belongs, with "the magic pendulum" and "Planchette" among the toys of children. Or if it be worthy the attention of scientific students, it is the students of psychology and biology, not of geology and hydroscopy and the science of ore deposits, who can profitably consider it. For us miners and prospectors the advice holds good which was given us 300 years ago by the wise Agricola, the father of our profession, who says the believers in the rod find some veins with it by accident. *Sed idem multo sapius perdunt operam, et ut venas invenire possint, nihilominus in fossis agendis defatigantur, quam adverso partis metallici*—"but the same people much more frequently lose their pains, and in order to discover veins have to fatigue themselves with digging, not less than the miners of the opposite school."

As a piece of sorcery, he goes on to say that the virtuous and respectable miner will avoid it; as a piece of science, it is inferior to the study of nature, following the indications of which the skillful and prudent miner selects a good place for exploration, and *ibi metallicus agit fossas*—"there the miner digs"—to which business, rod or no rod, he is bound to come at last.

THE ARGENTINE RAILROADS — GREAT PROGRESS MAKING IN THEIR CONSTRUCTION.

The following railroad news is copied from the message of the President of the Argentine Republic of South America, in which country there is flowing a heavy Italian immigration:

On the ten lines of railways—National, provincial, and private—now being laid down in the Republic, there are 14,500 Italian navvies at work, and this figure alone shows the progress we are making in means of communication. Nevertheless all this is unequal to meet the growing wants even of places that were considered the most barren.

Thus, no matter in what direction a railway is laid down, production, trade, and population spring up as if by magic. The desire of the people for such a powerful agent of wealth is quite natural, and the efforts of the engineers, and the lines building, are equally unable to satisfy it. Very soon these walls will echo the public demands in this direction.

The Central North Railway yielded in 1881 $583,018, and in 1882 $819,610, an increase of $226,592. The increase in the freight traffic was 19,000 tons. The line is being relaid with steel and the rolling-stock improved and increased.

No efforts have been spared to impart vigor to the works on the extension to Salta, and all the necessary materials for carrying them ahead have been collected. Very great difficulties were met with just outside Tucuman, owing to the nature of the soil and scarcity of labor and means of transport; but they have, for the most part, been

surmounted, and the works are going on vigorously. The 1st of April the directing engineer had 3,200 navvies at work, and during the year 1882, in spite of all the difficulties in the way, over a million cubic meters of earth were removed.

The Executive has decided to ask the Government of Bolivia, on its side, to make the surveys necessary for extending the line to the chief cities of that Republic, as the relations and importance of the trade between both countries demand the speedy carrying out of this enterprise.

The Andine Railway produced in 1882 49.83 per cent. more than in 1881, in spite of the lack of cars and locomotives, which are only now beginning to arrive from England. The most difficult part of the line has been carried through the Province of San Luis; and I can give you an assurance that, in the beginning of next year, the locomotive will be at the foot of the Andes, resting, after its long journey, under the shade of the leafy avenues of Mendoza. The zeal and intelligence of the Director-General of the works of this other great iron artery of the Republic are worthy of all praise.

The branch to Santiago was commenced at the end of last year, and there are 1,000 navvies at work on it. The railways guaranteed by the nation—the Central Argentine, the Campana, and the Eastern—have all increased their traffic considerably, the first-named line especially, and its rolling-stock is quite insufficient to meet the demands of trade and industry on it, so much so that there is a general complaint from all the provinces served by this great line.

The Transandine Railway, which starts from Mercedes, in the province of Buenos Ayres, and will join the Andine at Mercedes in San Luis after its course over lovely plains that were not long ago the haunt of the savages, is now being laid down at both ends of the line.

The surveys of the line to Rioja and Catamarca are finished from Recreo to Chumbicha and are being continued from this point to both cities. I hope that you will this year vote the funds necessary to commence the works.

The province of Buenos Ayres has given a great impulse to the extension of its railways, which are spreading like rays to the farthest boundaries of its territory.

The province of Santa Fe, with its own credit and resources, has commenced two lines—from Rosario and its capital—to its numerous wheat colonies.

Private enterprise and the desire for works on a large scale, which is now apparent, will certainly ere long come to second the efforts of the Governments.

ACROSS THE ISTHMUS.

[Correspondence Washington Republican.]

Two trains are run daily each way over the 47 miles of railway between Aspinwall and Panama, one leaving at 7 in the morning and the other at 1 in the afternoon, and each train occupies four hours in making the trip.

We were to leave by the early train, so a few minutes before 7 we entered the cars. They were clean, and looked like those at home, except that the seats were covered with matting and there were no windows, only blinds to exclude the rain and dust. We started punctually, and in a few moments were slowly passing the French buildings at the mouth of Fox River, which is at the western end of Aspinwall.

They have filled in quite a large tract of ground here and are enlarging it all the while, and on this ground they have built quite a number of neat houses for their employés. The sides are generally of wood, painted gray, and the roofs of corrugated iron, painted red. Near the car track they were putting up a fine bronze statue of Columbus with an Indian maiden, which statue was presented by the ex-Empress Eugenie to the town, and which has stood in various places in the vicinity at different times. Then there were several work-shops, and in one of them they were very busy putting together machinery that had been sent out in pieces. We could see three dredges hard at work deepening and widening the river, which they intend to use for some distance. Crossing the river, we soon lost sight of it behind Monkey Hill.

Monkey Hill is the cemetery of Aspinwall; it is quite high, steep and there are some trees upon it. A few graves are fenced about and seemingly cared for, but most of them were marked by a dilapidated wooden cross, and appeared as if the unfortunates had died of some malignant disease, and their friends burying them out of the way had forgotten them. It was desolate, and even seemed to lack the luxuriant tropical growth that now began to greet us on both sides of the way.

Everything that met my eyes was strange, from the tall, flowering trees to the low lilies in the ditches, except, perhaps, the white spider lily, of which I had seen a few in Florida. There were wild bananas and cocoanuts, tall palms, with long bunches of bright red palms, oil nuts, tamarind trees, with many scarlet blossoms that showed clearly against the small pointed glassy leaves, strange ferns, and numerous other beautiful growths that I could not find out the names of. The whole made a dense jungle, and about and around flitted hundreds of butterflies, the most striking of which were as large as my hand and of a bright metallic blue.

I was astonished to find the train stopping at different stations, as I had never read or heard of there being any before, so I took down the names of some, and give them for the edification of those who are ignorant as I was. They are Chagres, Puolo, Buena Vista, Mamei, Gorgona, Haut Obispo, Bas Obispo and Rio Grande Superieure. They were all composed of a few well-built buildings belonging to the French, a nice house for the station master, and a lot of native huts scattered about promiscuously. These huts were made of poles stuck in the ground and cross poles tied to them at the top with strips of raw hide, and these top poles supported a heavy thatched roof made of cane and banana leaves. The sides were covered with split cane, sometimes woven like basket work, and this was tied on with strings of any kind. Very few of them boasted of more than one room, but there were generally a number of small children playing around the fire, and numbers of their elders outside watching the train. In these gatherings the men wore breeches, the women voluminous trailing calico skirts and chemise made of coarse curtain lace. The children generally wore nothing.

The resident French superintendent of the canal was on the train, and I enjoyed very much talking with him, as well as the noise of the train would allow, about his work. Instead of being, as some might suppose, a ponderous, elderly gentleman he was tall, slight and may perhaps have seen 40 years, but he did not look it. His light brown hair was still unstreaked with gray and he had lost none of his inherent French politeness during a two years' residence in a comparative wilderness. Their route is not only well planned and surveyed, but cleared of undergrowth—no small task—and they have been leveling the highest places that they must cross on the divide. They are dredging in Fox River, already having a depth of 30 feet on the bar, which is all they wish. They have 8,000 men at work, mostly negroes. They pay $50 a head for them landed at Colon (as he and all Frenchmen call Aspinwall), in addition to which they receive $1 a day wages.

All necessary buildings, such as quarters and hospitals, are finished, and whenever it is possible they are placed on an eminence or slope. They have been very fortunate so far, only losing on an average one man a day. Five died the day before at Colon of fever, and when the wind blew down the Chagres River he said it was very deadly. If no epidemic should occur he hoped next year to have something to show for the immense sums expended, but he would not venture an opinion as to when the gigantic task would be accomplished. He was very warmly dressed, although the day was sultry, and said that he found it necessary to dress warmly and lead a very regular life, abstaining from all alcoholic drink. He said the overseers at the interior posts were too apt to forget and make the time pass, but that meant death.

The deepest cutting is to be 397 feet, and near this they are constructing a large reservoir to receive the overflow of the Chagres and prevent a freshet in the rainy season. We are told that in 1878 the railway had 30 miles of track under water, and a heavy iron bridge was lifted and turned around by this same river. It was apparently a much dreaded stream, but now was quietly rolling along well within its banks, the water very muddy, and its surface was frequently dotted with dugouts and other native boats.

The canal follows the line of the railway closely until it nears Panama, when it turns slightly to the eastward and comes out at a place called Ancon.

We looked under the ties of the railway for the Irishmen that are said to lie one under each tie, but they were not visible. We saw frequent wrecks of cars, however, and were informed that we were fortunate to get over without running off the track, as it was a frequent occurrence, but seldom resulted in the injury of any one, as they go so slowly.

BRAZILIAN RAILWAY ENTERPRISES.

The (Mexican) *Two Republics*, in an editorial on Brazilian railway enterprises, says:

Eight years ago Brazil passed a general law to authorize the construction of railroads. By adopting this course, which has been pursued in some States of the American Union, the empire did away with the necessity for special legislation, and enabled people to select their own routes with the certainty that there would be no delay in complying with the provisions of the law. This general law guarantees 6 per cent. on the capital invested, but prior to securing this guarantee the Government Inspector must be satisfied that the proposed railroad would pay 4 per cent. This provision is intended to exclude from Government support lines which are not likely to benefit the country or the stockholders. Four per cent. is so moderate a limit that the stipulation cannot stand in the way of any good scheme, while it ought to prevent people from starting wildcat enterprises to secure the guarantee.

Five railways have been constructed with guarantees, all of whose £20 shares are now sold on the London market at premiums ranging from £1 to £4. The Brazil Great Southern Railway, which recently placed its shares on the London market, uses the guarantee to insure the payment of interest on these shares, thereby giving them at once possitive value. In addition to the privilege which the company thus enjoys under the general law, it is accorded a charter for ninety-nine years, with exemption from competition within a zone of twenty kilometers on either side of the railroad. The Government reserves the right "to approve the tariff of fares" and to reduce the same when the dividends shall have exceeded 12 per cent. for two consecutive years. The Government is at liberty to purchase the line after thirty years, at a price to be determined by the average net income of the five preceding years, while after ninety years the Government may acquire the property at its actual value.

THE LICK OBSERVATORY.

The Supervisors of Santa Clara, Cal., visited Mount Hamilton the other day to see what had been done with the $700,000 bequerthed by James Lick to found an observatory. The great dome will cost $100,000. Of the $135,000 already expended, $35,000 has been invested in instruments and a library. These are in the city of Washington, awaiting the completion of the observatory buildings.

The great dome will be a vast revolving globe. The upper half will be roofed in, and the lower half will be an open framework. The observer's chair will be in a fixed slide, attached to the interior of the globe, and can be moved only up and down. At the bottom of the globe is a round aperture, through which will pass the pillar that will support the telescope, and around the bottom is a heavy iron tramway that rolls on the wheels. These wheels are on a shoulder of the pillar, and they support the entire weight of the globe. The globe is moved by pneumatic power, and the turn of a cock revolves it at will. There is an appliance for opening and closing the slit, which is in two parts, and can be opened at any point.

There will be electrical appliances at the observer's hand, connecting by wire with the chronograph in the transit room, so that by slightly touching a key the observer can record an observation. The observer's chair revolves with the dome. In February last Fell, who is casting the object glass for the great telescope, broke a lens on which he had expended many months, and this involved long delay.

WETTING LEAD PENCILS.

The act of putting a lead pencil to the tongue to wet it just before writing, which is habitual with many people, is one of the oddities for which it is hard to give any reason, unless it began in the days when pencils were poorer than now, and was continued by example to the next generation. A lead pencil should never be wet. It hardens the lead and ruins the pencil. This fact is known to newspaper men and stenographer. But nearly every one else dose wet a pencil before using it. The fact was definitely settled by a newspaper clerk away down east. Being of a mathematical turn of mind, he ascertained by actual count that of 50 persons who came into his office to write an advertisement or a church notice, 49 wet a pencil in their mouths before using it. Now, this clerk always uses the best pencils, cherishing a good one with something of the pride a soldier feels in his gun or his sword, and it hurts his feelings to have his pencils spoiled. But politeness and business considerations require him to lend his pencil scores of times a day. And often, after it had been wet till it was hard and brittle and refused to mark, his feelings would overpower him. Finally he got some cheap pencils and sharpened them, and kept them to lend. The first person who took up the stock pencil was a drayman, whose breath smelt of onions and whiskey. He held the point in his mouth and soaked it several minutes, while he was torturing himself in the effort to write an advertisement for a missing bulldog. Then a sweet-looking young lady came into the office, with kid gloves that buttoned half the length of her arm. She picked up the same old pencil and pressed it to her dainty lips preparatory to writing an advertisement for a lost bracelet. The clerk would have stayed her hand, even at the risk of a box of the best Faber pencils, but he was too late. And thus that pencil passed from mouth to mouth for a week. It was sucked by people of all ranks and stations, and all degrees of cleanliness and uncleanliness. But 'twere well to forbear. Surely no one who reads this will ever again wet a lead pencil.

STEEL RAILS.

THE BEST LENGTH TO MANUFACTURE RAILS STILL A QUESTION.—The question of the most economical length for rails in still unsettled. In connnection with a discussion of the question of long or short rails it is stated that the first line opened in France —viz, that from Saint Etienne to Andrezieux— had rails only 3 ft. 11 inches long, and weighing 45 pounds. This was in 1828 but in 1832, on the line from Saint Etienne to Lyons, the rail had increased in length to about 14 ft. 8 inches, and weighed 132 pounds. Various increases were made up to 1855 in France, when the length reached 19 ft. 6 in. England came in with a rail measuring from 21 to 24 ft. with a weight of 110 pounds per 39 running inches. In Austria the Francis Joseph line far exceeded this length, out was one-eighth less in weight. The great objection in the lengthening of iron rails is that the rail exfoliates and is damaged at any point—in fact the South of France Railway Company finds that only one-third of the rails are damaged at the ends. The greater length also involves more labor in the removal and replacement of rails. The use of cast steel changed the whole question, and now rails are turned out in Belgium and France 85. ft. in length. The long rail adopts a curve more readily owing to the absence of joints.

ENGINEERS' CLUB OF PHILADELPHIA.

ROOMS, No. 1,523 CHESTNUT STREET, Philadelphia, Pa.

Regular meeting, Saturday, October 20, 1883, at 8 o'clock p. m.

Report of Committee on Memorial of the late John C. Trautwine, honorary member.

Marine architecture.

The designing of steam boilers.

Early mining operations in Berks and Chester counties, including the present condition of the Jones & Warwick iron mines.

Notes on a Code of Conventional Colors.

RECORD OF REGULAR MEETING, OCT. 6, 1883.

President Henry G. Morris in the chair; eighteen members and one visitor present.

Mr. Edward Thiange presented an illustrated description of a method of earthwork computation by means of diagrams, constructed from the proposition "The areas of similar figures are to each other as the squares of their homologous sides." An idea may be had of their nature and uses by the following directions: To get the average volume in cubic yards of a station (in embankment), to the centre-fill at each end add the constant height of the "grade triangle" (which is formed by the roadbed and the side slopes produced); at the resultant heights on the diagram, measure, with the scale of cubic yards, the lengths of the ordinates terminated by the slope lines at each station respectively; their sum, diminished by the "grade prism," is the average quantity for the station of 100 ft.

A paper upon Economy in Highway Bridges by Prof. J. A. L. Waddell was read. Its objects are to etermine the most economical depth and number of panels for spans from 40 to 200 ft.; the lengths at which it is better to change from pony truss to through bridge, and from single to double intersection; the exact dead loads and the amounts of lumber and iron for each case.

The secretary presented a photograph and description of the Lift Bridge for double-track railway over Oswego Canal, N. Y., W. S. & B. R. R., kindly contributed to the club by Mr. Jno. A. Partridge (member Am. Soc. C. E.), Division engineer. Length of truss, 94 ft.; height, 23 ft.; width, 30 ft. 4 in.; angle with centre line, 38°; weight of bridge with machinery, 146 tons; weight of counter-weights, 138 tons; height of lift from bridge seat, 10½ ft.; time required for lift, 30 seconds.

HOWARD MURPHY,
Secretary and Treasurer.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

DLXXII.—PEABODY, MASS.

(*Continued from page* 482.)

Peabody, Massachusetts, in lat. 42° 35' N., long. 70° 55' W., is on irregular ground, rising from tidewater to an elevation of 160 ft. It was formerly called South Danvers.

The town was first supplied with water by the Salem and Danvers Aqueduct Company, incorporated April 7, 1797, with a capital of $10,000. Water was first furnished in 1799 by gravity from a reservoir in which the water of springs was collected, and distributed through bored pine logs of 3 in. diameter. In 1804 logs of 5-in. bore were substituted. In 1834 the first iron pipes were laid, of 6-in. diameter. Additions were made from time to time, and in 1859 the company had expended $246,200, laid 40 miles of pipe, and had 3,400 water takers. Separate water-works were built by the city of Salem in 1868, and by Danvers in 1876. The works of the old company were purchased by the town of Peabody in 1873 for $125,000, comprising Spring Pond, which has an area of 59 acres, at 60 ft. above tide level; Brown's Pond, and two stone reservoirs 300 by 100 ft. and 5 ft. deep.

In 1881–82 high service works were built by the town, taking the supply from springs and pumping it by a Worthington steam pumping engine of 5 million gallons daily capacity into a stand-pipe 25 ft. high, on ground 159 ft. above tide. Distribution is by 4.6 miles of pipe, of from 16 to 2 in. diameter. The old mains are of cast iron and the new ones of cement-lined wrought-iron, and the smaller sizes of galvanized iron.

There are 130 fire hydrants and 1,300 taps.

The population in 1880 was 9,028. The daily consumption in 1882 was 586,359 gallons on the high service and about 500,000 gallons on the low service, The expenses were $3,010 and the receipts $17,504. The works have cost $233,580, and the bonded debt is $215,000, at from 4 to 7 per cent. interest.

The works are managed by five water commissioners. D. S. Littlefield is chairman of the Board.

THE GEODETIC CONGRESS.

LONDON, Oct. 16, 1883.

An International Geodetic Conference is being held in Rome. Among the delegates present is General R. D. Cutts, of the United States Coast and Geodetic Survey.

A COMMON MERIDIAN.

The Congress opened on Monday with delegates from all the European States present. There were also in attendance four representatives from the United States. Signor Baccelli delivered an address in Latin, in which he warmly congratulated the people of America upon their first participation in the deliberations of a body having objects similiar to those of this Congress. The adoption of an international common meridian and common time for railway and telegraph purposes is to be discussed.

ON GEODETICAL OPERATIONS.

TO THE EDITOR OF ENGINEERING:

SIR: In view of the approaching International Geodetic Congress to be held at Rome in October, it may be opportune to sketch out some features of geodetic operations which demand attention.

The main aim of all geodetic operations on the grand scale should be to find the configuration of the water or seas upon the surface of the earth; the land, at any or different places, will but vary in contour as indicated by references to mean sea levels at their latitudes. Apart from practical difficulties, such as the delicate operation of measuring a base and necessary reduction of alterations of lengths of measuring rods produced by variations of temperature to a fixed state of the thermometer and also a certain hygrometric state of the atmosphere; corrections required for refraction; reduction to the centre when instruments cannot be placed at centre of a station which is the true angular point of a triangle, etc., the *theory* of geodetical operations and its intricacies, or rather its delicacies, may be represented in a very simple manner as follows: Let us suppose we wish to make a horizontal sun-dial; we require its gnomon to be parallel with the earth's axis. In order to fix the gnomon (which may be a mere rod) if we level our dial-plate according to the natural level of its place as indicated by the spirit-level and plumb-line we have, after allowing for our latitude, to allow also for the angle of the vertical, that is, for the swing of the plumb-line equatorwise in consequence of the rotation of the earth about its axis and the configuration of the earth approaching somewhat to that of a spheroidal solid of revolution. If we fix the gnomon of our sun-dial correctly (that is, if our angular values of latitude and angle of the vertical be correct ones) we should then (after allowing equation of time) always have correct time indicated. Now, the first requirement of geodetical operations is to fix a supposititious true sphere osculating the surface of the earth at the poles, wherewith to compare the actual contour of the earth, and in fixing this base of operations we are, perforce, obliged to correct our apparent latitudes by the amounts of *theoretically* derived angles of the vertical in order to arrive at true latitudes referred to osculating sphere.

It has been seen that in fixing a sun-dial, if the theoretical angle of the vertical and apparent latitude afford us correct angle of the gnomon (or of earth's axis), the dial will indicate true time. An analogous astronomical operation—apparent latitude, theoretical angle or the vertical, and the equation of time being given—will inform us if we are, in geodetical operations, making true reference to an osculating sphere, or, practically, if our theoretical angles of the vertical be correct.

On a true sphere all degrees of latitude would be, if actually measured on its surface, of the same or equal length, and the differences of lengths of *true* degrees of latitude measured on our earth's surface would indicate its contour.

In geodetical operations, then, we require to know true geocentrical latitudes of every part of a triangulation, and therefore, in order to obtain such, require to know true angles of the vertical at every post or station.

Now, in practice, we would assume if astronomical observations of the character before mentioned afford us true time, that our latitude and angle of the vertical are both correct, though this, when it comes to be examined into, proves to be no more than *assumption*, as the total of the angle of latitude and angle of the vertical may be correct, when neither the one nor the other may itself be so; and when we find, at different parts of triangulation, differences of angles of the earth's axis not to be expected from actual measured *and combined theoretical* latitudes obtained geodetically, we look out for some cause of such difference, such as, for instance, the proximity of a mountain, or, on the other hand, of a concavity beneath earth's surface, or equivalent less than ordinary dense strata.

If differences betwixt theoretically and geodetically derived angles of the earth's axis occur but seldom, and we find proximity of mountains or other natural causes of such, we rest satisfied with the theoretical angles, but if such differences occur more frequently during a triangulation, and natural causes of them are not so apparent, then we adopt the mean of such differences and alter our theoretical angles of the vertical accordingly. But even then we may not arrive at the *true* proportions of angles of vertical and of latitude, which together make *true* angle of earth's axis, and, consequently, may not arrive at perfectly true comparison of the figure of the earth with that of its osculating sphere.

It cannot be too strongly brought to notice that, in geodetical operations, *we work to a contour derived from angles of the vertical.* We reduce all observations at every part of a triangulation to such contour. We are, in fact, and because of the very nature of the mathematics employed in reducing our observations, working to a *preconceived contour* (liable to corrections of angles of the vertical, as shown in the preceding paragraph, but the angles still remaining theoretical), and if we take but one sea level (as Liverpool old Dock Sill, for instance, in our own insular operations) whereto to refer our contour to, we do not even make an aim to work to *actual* contour of the earth.

But it may be be said that, having corrected original theoretical angles of the vertical, we are afterwards working as nearly as human means will allow of, to true contour of a solid of revolution. Not so! for the plumb-line swings freely, or rather, far more freely than any matter having the slightest cohesive property or viscosity, and thus the swing of the pendulum equatorwise would indicate an exaggerated oblateness and greater than the oblateness of a fluid upon the earth's surface, and rotating about its axis.

Again, the mere taking one or a few sea levels whereto to refer our contour yet leaves the contour betwixt any two sea levels which may be comparatively distant from each other, the *imaginary* contour which the mathematics employed in the reduction of observations affords us.

Actual mean sea levels should then be taken at the latitude of *each* post of a triangulation, and the greater the number taken the better, and the nearer may be the approach to true contour.

But it has been urged that the agreement of measurements of bases of verification with the measures of such derived from the series of triangles of a geodetical operation are sufficient to prove the accuracy of the operation itself. So they are! But *not* to prove that the *contour* of the base of verification is otherwise than the preconceived and partially corrected contour of the triangulation as a whole, for, in making actual measurement of a base of verification we would make the same allowance for angles of the vertical as in making the triangulation, and thus the base of verification would perforce assume the contour of the triangulation as a whole. To prove that a geodetically derived contour agrees with the *real* contour is another matter, and may, indeed, be entirely out of human power to compass.

To arrive at geodetic truth will be seen, from the foregoing, to be a very difficult and, perhaps, even impossible matter; but to make the affair still worse there occur in nature daily, and even hourly deviations of the angles of the vertical; these deviations may be said to be primarily of tidal characters, they will indicate in somewhat similar manner as ocean tides do the effects of the sun and moon on the rotation of the earth about its axis, and will indicate the same variations of such effects as the barometer does after allowances are made for changes of temperature, density, etc., of the atmosphere. The writer mentioned this fact, and more in a contemporary before the Darwin brothers commenced their observations on the variations of the angles of the vertical and indicated an instrument such as the suspension of, a heavy pendulum whereby observations of variations might be made.

M. Plantamour assumed all variations of angles of the vertical at his place of observation to be due to local earth disturbances, but such is not the

fact; they are as aforesaid, and primarily of as general a character as tidal oscillations are.

Then, angles of the vertical being so variable, during a geodetical triangulation constant observations of vertical variations should be made at a special observatory, and the time of making each observation of the geodetical operation should be noted and the deviation of the angle of the vertical at that time—as solved at the observatory—should be allowed for in correcting the latitudes of every post of the triangulation.

But, again, affairs are even yet more complicated, for in order to pursue geodetical operations correctly we should have a standard *actual*, and not merely theoretical angle of the vertical for some one latitude, if possible; and, as angles of the vertical (after allowing for aforesaid tidal, etc., variations) vary because of proximity of mountains or dense strata, or of chasms or strata of slight density, we may have places of different longitudes but all actually situated on small circles of the earth, yet not appearing from astronomical observations to be situate on the same parallel latitude; or, we might plot out a perfectly straight line tending due east and west, and places situated exactly on such line might yet differ in observed latitude. From such considerations we see the necessity of fixing a standard *actual* angle of the vertical derived from the mean of observations made in different longitudes on a small circle of the earth. Until we do so, we practically assume that the matter of the earth is perfectly homogeneous, or, that our post of observation at any given latitude is situate over, or about, strata of truly average densitv.

A brief outline of the actual requirements of a correct geodetical operation is afforded in the foregoing, and enough has been said to show that there is plenty of work for an International Geodetic Congress in the correction of former errors and the preparation for future operations of more refined and precise characters than those of the past.

G. PINNINGTON.

23 Chichester street, CHESTER, Sept. 1, 1883.

NOTE.—Schehallien, in Perthshire, is an example, of a mountain affecting the angle of the vertical, and near Moscow and elsewhere in Russia, and Siberia, there occur southerly swings of the plumb-line which can only be accounted for by supposing concealed chasms to exist below the surfaces at such places.

TRACKLAYING IN 1883.

The *Railway Age* says: Railroad building has proceeded, so far this year, with much vigor, notwithstanding the assertion, freely made at its commencement, that construction had ceased. The mileage of new main track from Jan. 1 to Sept. 30 is as follows:

States.	Miles.	States.	Miles.
Alabama	129	Mississippi	226
Arizona	155	Missouri	84
Arkansas	97	Montana	251
California	227	Nebraska	44
Colorado	41	New Jersey	5
Dakota	288	New Mexico	81
Florida	101	New York	307
Georgia	64	North Carolina	12
Idaho	210	Ohio	195
Indian Territory	12	Oregon	65
Illinois	150	Pennsylvania	296
Indiana	127	South Carolina	28
Iowa	69	Tennessee	30
Kansas	42	Texas	53
Kentucky	61	Utah	160
Louisiana	161	Virginia	58
Maine	15	Washington Ty	44
Maryland	15	West Virginia	45
Massachusetts	17	Wisconsin	106
Michigan	142		
Minnesota	35	Total	4,24

At this date in 1882 we reported 8,075 miles of track laid on 260 lines, against 4,244 miles on ninety lines for the corresponding period of 1883. Assuming a similar comparison for the entire year, the railway mileage laid during 1883 is likely to aggregate about 6,000 miles, which will exceed the record of any year previous to 1880, when the "boom" began. We have a record of nearly 150 lines upon which tracklaying is still in progress or expected to commence this year, and our own estimate now is that the total extent of track laid during 1883 will be between 6,000 and 7,000 miles.

MEASURING THE INTENSITY OF LIGHT.

A new method of measuring the intensity of light was proposed at a recent meeting of the British Royal Society. The standard of reference is a small surface illuminated to a given intensity, and the mode of comparison is the light given by a small glow lamp, whose state of incandescence is raised or lowered by increasing or diminishing an electric current. The amount of illumination is measured by the amount of current flowing, so that the number of ampéres gives the degree of illumination. The standard surface is that illuminated by a British "candle" at 12.7 inches, and this is the same as that produced by the French "bec" at one meter distance. In this way sunlight, moonlight and the amount of illumination in any part of a room or building, or that distributed over a street or area at any time of day or night, can be measured without any reference to the source of light or its distance from the point light.

AMERICAN SOCIETY OF CIVIL ENGINEERS, OCTOBER, 18, 1883.

The Society met at 8 p. m., Director Wm. G. Hamilton in the chair; John Bogart, Secretary.

A paper by Mr. C. J. Appleby, Member Institution of Civil Engineers of England, on the subject of cranes as labor-saving machines, was read by the author, who remarked that a well-constructed crane, or other similar power machine requiring only one man to drive it, would do as much work as could be done by the manual power of ten men, but in one tenth of the time they would require. It seems singular that railroad and water-side depots and work-shops should so rarely be laid out with reference to the employment of such labor-saving machines. The most economical working result is obtained from machines so arranged that when they take hold of the load it is not released until final deposit. The author considered the following systems for transmitting or applying power:

1. The well-known hydraulic system, with pressure pumps, accumulator and distributing pipes.
2. Compressed air distributed through pipes.
3. Steam distributed as above.
4. High-speed rope, or "endless cotton cord," which runs at a speed of 5,000 to 6,000 ft. per minute.
5. Low-speed rope, running 1,500 to 2,000 ft. per minute.
6. Square shaft supported on tumbler bearings.
7. Steam from a boiler delivered on the top of a piston with multiplying chains similar to the hydraulic system.
8. Boiler and engine fixed on the crane and driving gear for the several motions required.

The 1st, 2d and 3d can only be applied to cranes fixed or moving over very limited areas. The 4th, 5th and 6th will transmit power over large areas, which, however, should be nearly rectangular. The other two can be used generally wherever there is a railway track. The hydraulic system possesses great advantages over compressed air or steam, but experience tends to the conclusion that its common use will be attended with considerable inconvenience where the winters are cold. The use of compressed air has not been applied with great success in many cases.

Steam is largely used, and frequently carried through 1,000 ft. of pipe without much inconvenience. The high speed cotton cord runs at a speed of 5,000 to 6,000 ft. per minute. The cord works in grooved pulleys, is carried on rollers or other supports at intervals of ten to twenty-five ft., and is kept in tension by a weighted pulley. Low speed rope transmission is generally effected by a hemp rope running from 1,500 to 2,000 ft. per minute. The square shaft has been used for many years, the only special difficulty experienced being that of supporting the long main line of driving shaft. The author exhibited recent designs whereby this difficulty has been very successfully overcome. The relative advantage of rope or shaft transmission is largely influenced by local circumstances. As a general rule the rope system costs less and is better where the distance for transmitting exceeds 200 ft. Below that distance the shaft is probably the best and cheapest. But the rope possesses advantages when machinery has to be driven at different levels, or at an angle with the point from which the power is transmitted. The steam crane employed under many different conditions perhaps performs more functions than any other mechanical arrangement for lifting and placing loads. All such cranes should lift and turn around by steam power. One specially illustrated has additional motions for altering the radius of the jib, for hauling materials so as to bring them within the reach of the machine, and also for moving empty or loaded cars. Fixed cranes are often seen so placed that ⅓ or even ½ of the number erected at a particular point are idle. It would therefore seem that for the same outlay the best duty will be obtained from movable cranes. Where two or more railroad tracks are parallel with the water front it will often be desirable to make the crane span the two lines of tracks, allowing head room for the vehicles to pass under it. Cranes fixed on floating vessels were also illustrated up to 60 tons power. Locomotive cranes up to 25 tons were described and also cranes specially adapted to terminal freight stations. One of these has lifted 80 tons per hour a height of 20 to 30 ft. and deposited the loads of 1½ to 2 tons each 60 ft. from the point where taken up. A similar crane commonly delivers 240 barrels of oil per hour the same height of lift and length of deposit.

The cost per day is one driver's wages and the necessary fuel, oil, etc. Five per cent. per annum is ample allowance for depreciation. The cost of this system of working is easily ascertained, but a great gain also arises from the increased speed of passing large quantities of merchandise.

The paper was discussed by Messrs. Cartwright, Cooper, Emery, Forney, Geo. S. Greene, Jr., Hamilton, R. L. Harris, James Platt, and the author.

BOOK NOTICE.

"KINEMATICS. A treatise on the modification of motion as affected by the forms and modes of connection of the moving parts of machines. Fully illustrated by accurate diagrams of mechanical movements, as practically constructed. For the use of draughtsmen, machinists and students of mechanical engineering. By Charles William MacCord, A. M., Sc. D., Professor of Mechanical Drawing in the Stevens Institute of Technology, Hoboken, N. J.; author of 'Lessons in Mechanical Drawing,' 'A Practical Treatise on the Slide Valve and Eccentric' and various monographs on mechanism." John Wiley & Sons, Publishers, New York. Price, $5.00.

The title of this latest published work upon the science of motion sufficiently expresses the purpose of its author. In treatment the subject is handled in a practical manner, for the benefit of practical men. The demonstrations are made, as far as possible, to depend directly upon carefully drawn diagrams of such character that, used in connection with the accompanying explanations, any ordinarily expert draughtsman should be enabled to "lay out" with ease and accuracy any of the movements treated upon.

An appendix contains the methods of construction of movements and other graphic processes, so separated from the body of the work that these methods may be more easily referred to, and also that the argument may not be interrupted by subordinate discussion.

As the possibilities of mechanical combinations and movements are enormously great, the author has necessarily been compelled to select from this vast array a comparatively small number of devices for treatment. But after considering the general methods by which motion, and the modification of motion, may be represented and analyzed, and the basis upon which a proper classification of elementary mechanical combinations may be made, he has selected those movements of the greatest practical value for illustration. He first treats of pieces rotating in contact about fixed axes, and follows this with a treatise upon the varied forms of pitch surfaces or gear wheels of all kinds.

While acknowledging his indebtedness to the previous works of Prof. Willis and to Rankine, the author claims that his treatise is in no sense a revision of either; and that original investigations alone furnished the material for at least twelve of the topics discussed.

Both the nature of the subject and the method of treatment demand copious illustrations, and in this direction the general excellence of the present work reflects exceeding credit upon the designers of the plates and upon the publishers; the cuts are clear in expressing their purpose, artistically drawn, and very well engraved.

THE Ohio River dam improvements are nearly finished, at a cost of only $12,000. The work was in charge of Capt. Adams.

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TRANSACTIONS AMER. SOC. C. E.

The July (1883) number of the Transactions and Proceedings of the Society, which has just been issued, contains papers upon "An Accident to Steam Pipes Arising from the Use of Blast Furnace Wool," by Prof. T. Egleston, and "Geodetic Field Work," by George Y. Wisner, and also the discussion on Prof. Egleston's paper by Mr. Chas. E. Emery.

The Proceedings contains an extended memoir of William Raymond Morley, late Chief Engineer of the Sonora Railway Company in Mexico.

PHILADELPHIA'S NEW WATER SUPPLY.

The corps of engineers sent out by the Philadelphia Water Department to investigate the possibilities of an increased future supply have made a preliminary report on the Delaware River route. Mr. R. Hering, under whose supervision these surveys have been made, reports that a gravity supply from the Delaware Water Gap can be obtained at less cost than has been heretofore supposed, notwithstanding the contrary report of the commission of experts of 1875. The elevation of the water surface in the Delaware River at the Water Gap is 280 ft. above tide. With a fall of 1½ ft. per mile, the proposed aqueduct would deliver the water into the new Cambria Basin at an elevation of 165 feet above the same datum, furnishing an abundant head for nearly the entire city.

Chief Engineer Ludlow says that, while the tunneling and crossing of ravines will be considerable in amount, it will not approach the former estimate; but owing to the length of the line, some 90 miles, the aqueduct will still cost a great deal of money, just how much cannot be determined until the the quantities are worked up. A conduit 10 ft. in diameter would furnish 200,000,000 gallons daily to the city, sufficient for several generations, at least, to come.

THE PROPOSED AQUEDUCT ROUTE.

The Aqueduct Commissioners held a special meeting on Oct. 15 to hear persons interested in the proposed Hudson River route for the new Croton Aqueduct. Mayor Edson remarked that, while the original estimates of cost had been based upon hand labor in the tunnels with shafts only a half a mile apart, by the use of improved machinery the shafts would only be necessary once in 1½ miles, and the work still be finished in two years from the signing of the contract. Great delay would be caused by adopting the Saw-Mill route, as it had not yet been fully surveyed. Every engineer consulted had agreed that this last-named route was the most expensive, and that the Hudson River route was the best theoretic line.

E. S. Jaffray argued that the old and new aqueducts should be separated as much as possible, that no accident might affect both; he consequently favored the Saw-Mill route and stated that the property was less valuable, and the number of inhabitants affected less than on the Hudson River.

David B. Williamson, representing every property owner at Dobbs Ferry save one, said that the only question for the engineers to decide was whether they could overcome the difficulties on the Saw-Mill route and the difference in cost. He argued that the increased land damages on the Hudson would more than counterbalance increased cost of construction on the Saw-Mill line; he feared draining of the wells, and sickness caused by removing the material from the tunnels.

Mayor Edson said the lowest estimated difference in cost between the two routes was $1,500,000; the great difference was in the time required. Mr. Terry said he had good authority for stating the difference would not be $1,000,000, and on applying to Chief Engineer Church for his opinion, that gentleman remarked that less than $500,000 would cover the difference in cost, and that it should take no more time to build than the Hudson River line. Hon. Orlando B. Potter also opposed the route by the Hudson; he doubted the legal authority of the act by which the people of New York took land in an adjoining county by simply filing a map.

The commissioners have decided to have a more complete survey made of the Saw-Mill route.

ABOUT STREET CARS.

The American Street Railway Association opened the first session of their annual convention in Chicago on Oct. 9.

From the opinions expressed and experience related at the meetings we extract the following:

Georgia pine stringers laid in the roadbed in Troy, N. Y., twenty years ago, are perfectly sound to-day.

In Berlin (Germany) the ties are underlaid with concrete; the Stevenson car is most generally used; the fares are not uniform, 2½ cents is charged for short distances; the railway companies pay five per cent. of their gross earnings to the city government for the privilege of using the streets.

The English practice, as a general thing, requires a deep rail, and they keep the rails out of street traffic; the "Johnson rail" was considered deep enough to carry the rail firmly, the lower flange resting on the ground; 12⅜ inches was deep enough.

Several parties advocated the center-bearing rail, both for street traffic and for cars.

Mr. Wm. Wharton, Jr., thought the best track was made by a 60-pound centre-bearing rail, laid upon yellow-pine stringers.

In Topeka, Kansas, a four-foot-gauge track was used, owing to a bridge to be crossed; mules are used exclusively; yellow-pine stringers were found to decay rapidly in the clay soil of that section, and oak has been substituted.

In Buffalo, N. Y., experience has proven that yellow pine would last four years in clay and twelve years in sand.

At the St. Louis Bridge timber imbedded 17 years was perfectly sound when taken up; the same quality of timber laid near the surface and alternately wet and dry, lasted from three to six years.

The heating of street cars is yet in an unsatisfactory state of development, as decided by the majority of members present, and this majority deemed it best not to attempt heating at all.

The Committee on Propelling Cars report the impossibility of obtaining anything like unanimity of opinion on the subject. The thing desired was to dispense with animal power. There were three ways of doing this: locomotives, elevated railways and cable roads. The committee conclude that the last named is the best of the three systems. The members were cautioned against patent "car-starters."

Mr. Holmes, of the Chicago City Railway, stated that while the cable road was yet an experiment, the saving over horse-power was very great, and they were enabled to run three times as many cars as formerly; the running expenses were reduced one-half. The wearing of the cables was very great; much more so in Chicago than in San Francisco, owing to the more frequent stops in Chicago. They had no trouble with the machinery. They had had considerable trouble at the curves, but had overcome that by improved machinery. The matter of grade was no objection whatever; the expense of construction of the road was $105,000 per mile; the total outlay was $2,500,000.

The Committee on Collection of Fares reported in favor of the portable register as preferable to stationary registers, and thought the bell-punch the best device in use.

STANDARD RAILWAY TIME.

The railways, as being naturally most interested, have taken hold in earnest of the problem of simply fixing the time standards of this country; and it is expected that before the beginning of 1884 every prominent road, at least, will have adopted the new system.

At the railway time conventions held in St. Louis and New York in April last the following resolutions were adopted:

1°. That all roads now using Boston, New York, Philadelphia, Baltimore, Toronto, Hamilton, or Washington time as standard, or standards based upon meridians east of those points, or adjacent thereto, shall be governed by the seventy-fifth meridian or "eastern time" (four minutes slower than New York time).

2°. That all roads now using Columbus, Savannah, Atlanta, Cincinnati, Louisville, Indianapolis, Chicago, Jefferson City, St. Paul, or Kansas City time, or standards based upon meridians adjacent thereto, shall be run by the ninetieth meridian time, to be called "central time" (one hour slower than "eastern time," and nine minutes slower than Chicago time).

3°. That west of the above-named section the roads shall be run by the one hundred and fifth and the one hundred and twentieth meridian times respectively (two and three hours slower than "eastern time").

4°. That all changes from one hour standard to another shall be made at the termini of roads or at the ends of divisions.

These resolutions were sent out with a pamphlet and map explaining the proposed plan, and a request that all parties interested should at once report, so that final action could be taken at the next convention. At the beginning of the present month railways operating 70,000 miles of road had responded favorably, and replies are being daily received; no road in the United States has as yet refused assent.

The plan proposed as the one in most favor is to have five standards of time, differing by consecutive hours, for the entire territory of the United States and Canada. These standards are based upon the meridians from Greenwich. For the railways in Canada the standard will be known as *inter-colonial time*, and shall coincide with the local time on the meridian four hours, or 60°, west of Greenwich. In the United States the standards will be known as *eastern*, *central*, *mountain* and *Pacific time*, and coincide with the local time on meridians five, six, seven and eight hours, or 75°, 90°, 105°, 120°, respectively, west of Greenwich.

The effect of this new departure will be that all time between any two standard meridians will be alike, and travelers within these limits will not be compelled to change to meet the local time at points 100 miles east or west of their starting point. Immediately on the time meridian the change will be exactly one hour, and the greatest difference between the true local time of any section of the country affected and the new time cannot exceed thirty minutes.

The great difficulty will lie in the selection of the points where the hour changes are to be made; the railway companies, in whose especial interest this innovation is to be brought about, demand that "changes from one standard to another should be made at the well-known points of departure," and that "these changes should be made at the termini of roads where changes now occur.' This demand is proper and required by railway interests; the only trouble lies in the fact that "these termini" of trunk roads do not fall upon the exact north and south dividing line required by theory; New York, for instance, lies in 74° west longitude, and Chicago 78° 35' west from Greenwich. Both are important points of change, and neither coincide with meridians of standard time.

THE BOUNDARY LINES BETWEEN NEW YORK AND PENNSYLVANIA AND NEW JERSEY.

The report of the Commissioners of the State of New York has just been received for the year ending Dec. 31, 1882. From this document we find that the boundary line has been re-established between the States of New York and New Jersey and considerable progress made upon the line dividing the first-named State from Pennsylvania.

In reference to the New Jersey boundary the report states that after a long season of dispute between the Proprietors of the East and West Jerseys and the New York patentees, a royal commission was first appointed in 1767, to whom were submitted the several points at issue between the two parties. This Commission met in 1769 and rendered a decision, by the terms of which the western terminus of the boundary line was fixed at the junction of the Mahackamack (now Navesink) River "with the river called the Delaware or Fishkill," at a point found by the surveyors employed to be in latitude 41° 21′ 37″. The Hudson terminus was fixed in like manner in 41° of latitude, a rock was designated and marked at each terminus. The partition line was declared to be "a direct and straight line from the said fork at the mouth of the Mahackamack in latitude 41° 41′ 37″ to Hudson's River at the said rock in latitude 41°."

In 1774 the line was actually laid down upon the ground, William Wickham and Samuel Gale were appointed Commissioners on the part of New York, and John Stevens and Walter Rutherford for New Jersey. James Clinton, of New York (afterward General in the Revolution), and Anthony Dennis, of New Jersey, were the surveyors who originally ran and marked the line first retraced.

The line established in 1774 has since remained the acknowledged and legal boundary between the two States. The present Commission was appointed in 1880, to ascertain the location of this boundary and re-mark it with new and durable monuments. The first fact revealed by an examination of the old survey was that it was not a "straight line," as had been supposed by the Commissioners of 1774. The report of the original surveyors shows that they traced the line with a magnetic compass, and as a result obtained not a straight line, but a curved line, known in navigation as a "rhumb line." This divergence was unknown until detected in the re-examination of the line by the better instruments and more accurate measurements of the present Commission. The actual divergence found is shown in feet by the following table:

Monument...	Divergence...	Monument...	Divergence...	Monument...	Divergence...	Monument...	Divergence...
1	65 6	13	904.8	25	2283.7	37	474.1
2	98.3	14	997.3	26	2331.1	38	343.8
3	152.3	15	1064.5	27	2311.3	39	276 7
4	222.3	16	1153.	28	2130.7	40	260.8
5	290.8	17	1271.5	29	1805.4	41	245.1
6	373.3	18	1501.2	30	1430.1	42	229.4
7	448.5	19	1752.7	31	1205.3	43	200.9
8	527.1	20	1919.2	32	978.9	44	182.7
9	600.3	21	2022.1	33	815.5	45	155.8
10	667.4	22	1972.9	34	679.4	46	99.3
11	732.8	23	2119.3	35	651.0	47	57.6
12	811.3	24	2218.8	36	697.0	48	17.1

But for more than a century the monuments on this crooked line had been recognized and acknowledged as the true partition between the States. The decisions of the U. S. Supreme Court have definitely held that such a settled line cannot be disturbed; and, besides, the act of Legislature appointing the present Commission expressly declared that the lines which have been recognized and legally acknowledged as the boundary line shall not be disturbed. Under these circumstances the old stones have been replaced when found, and, in case of missing monuments, a straight line was run between the nearest stones still in position.

The work of identifying the old line of 1774 and resetting the monuments was placed in the hands of Maj. H. W. Clarke, of Syracuse, for the State of New York, and Prof. Ed. A. Bowser on the part of New Jersey; these engineers entered upon their duties in the summer of 1880.

The original milestones were red sandstone posts, marked on the sides "New York" and "N. Jersey" and the number of the stone in the boundary. These have been replaced by granite posts four feet long, with the top dressed six inches square to a depth of six inches, with the inscription "N. Y." and "N. J." on the proper sides. Special monuments were erected where the line crosses public roads, railroads or rivers, and very substantial granite monuments were placed at the terminal points on the Delaware and the Hudson Rivers.

The report gives a detailed statement of the condition of each original milestone found, and the location of the new.

The work upon the Pennsylvania line is incomplete, owing partly to the failure of the Pennsylvania Legislature at the 1881 session to make provisions for continuing the work, but under an especial arrangement by which the Pennsylvania Commissioners agreed to pay one-half the expenses as soon as an appropriation was made the work was pushed forward, and so far 225 monuments have been established on the line between New York and Pennsylvania, under the supervision of Major Clarke. The line, as re-marked, now extends westward from the Delaware River, near Deposit, to milestone No. 120. There remain 142 mile monuments and about 210 road and other monuments to set. The work upon the western end of the line will require more time than that expended upon the eastern portion, as the monuments are in a much greater extent undiscoverable.

RAILROAD BUILDING.

The latest reports show that 4,629 miles of railroad have been constructed so far this year, as against 8,081 miles to the same time last year, and 5,340 miles to the same time in 1881. These figures cover only main track, and have no reference to sidings, of which a large number of miles have been built. There will be a rapid improvement from this time to the close of the building season. The estimated limit of this year's construction is 6,000 miles, but, from recent inquiry, it seems that this limit will be exceeded by from 300 to 500 miles, unless unusually severe weather should arrest the contemplated work. A better feeling is growing in railroad-building circles. Large contracts continue to be given out for cars, locomotives and equipments of all kinds. The bridge works report abundant activity, and the structural iron mills are in receipt of orders for large quantities of iron, and inquiries are in hand at this time for additional requirements which will occupy the full capacity of all of the structural mills up to the end of December. The increase in traffic is calling for more passenger and freight cars. The earnings for nine months of thirty-six companies reporting show an increase of 13 per cent. on an increase of 15 per cent. in mileage over last year. The average earnings per mile declined from $3,819 last year to $3,750 this year. Railroad men are satisfied with the present financial condition of the roads, and recognize the fact that the conditions are favorable to an early and steady increase in traffic and a probable improvement in dividend-earning power. The increase in the agricultural area is quite marked. The new population extending over the West will furnish, even within the next year, a considerable increase in business for railroads. The local traffic of the trunk lines shows a steady improvement. Southern and Western roads make a good showing, and the chances for improvement on them are as favorable as on any other of the leading lines.

Glancing at the work of construction, we find much to justify the favorable observations made as to the present and future condition of railway construction. A large number of small lines are under construction. The indebtedness of several roads has been re-bonded, and funds are being obtained for further extensions. The Denver & Rio Grande road will have nearly $14,000,000 by its recent blanket mortgage for present needs, and $10,000,000 for future requirements.

The Chicago, Milwaukee & St. Paul is constructing three or four branches; one of them 160 miles long, through the James River Valley; another is 74 miles long.

The Chicago, St. Louis & Western will soon complete its line parallel with the Chicago & Alton, and most of its length.

The Chicago & Lake Superior Company will build a road from Chicago, to connect with one of the same name in Wisconsin; capital, $1,000,000.

The Chicago, Burlington & Quincy reports an increase in gross earnings of 22 per cent. for eight months, or 29.7 per cent. net earnings.

The Atchison, Topeka & Santa Fé report an increase of 7 per cent. in earnings for eight months.

The Atlantic & Danville will construct a line 160 miles long from the head of sea navigation on the James River to Danville.

The Baltimore & Ohio Company have arranged for a regular weekly line of first-class steamers between Baltimore and Liverpool.

The Central Railroad of Georgia has made a treaty, offensive and defensive, with the Western & Atlantic, to protect itself from "Northern syndicates which threaten to swallow up all the roads in the South."

The Kanawha & Webster Company will build a road from Charleston, West Va., to Beverly, a distance of 120 miles.

The contracts for the construction of 7 long tunnels will shortly be let by the South Pennsylvania road, and work on them will be continued through the winter.

It is announced that the Union Pacific will build a 188-mile road along the Snake River in Oregon, and also a branch to the Yellowstone National Park.

The Southern Kansas Company show an increase in gross earnings of 37 per cent. for 8 months, and 39¼ gross earnings.

These are a few indications of the activity prevailing in our railway building.

THE NEW ATLANTIC CABLES.

The daily press of Oct. 18 announced the inauguration of the first essentially American cable enterprise. Messrs. J. W. Mackey and James Gordon Bennett signed a contract on Sept. 28 with Messrs. Siemens Brothers for two transatlantic cables, and they are now being made at the works of these gentlemen, near London. The first cable is to be open to the public on June 1, 1884, the second a few weeks later; $6,000,000 is said to be subscribed, mostly by American capitalists.

The company to be formed will be entirely American, and will be the only one so controlled. Its policy, as announced in the N. Y. *Herald* will be to maintain absolute secrecy of messages intrusted to it, to forward and deliver them with the utmost rapidity, and to charge only a fair tariff, such as sound common-sense business principles may dictate.

The public are assured that these cables are constructed to meet a popular and urgent demand for greater economy in rates and better administration; and that the present management are able to hold their ground without pooling with other companies, or tampering with the stock by a watering process for the benefit of the promoters.

Messrs. Mackey & Bennett evidently mean a very live competition, and their united capital, backed by the business training and ability of the latter gentleman, will certainly enable them to carry out their purpose. Healthy competition is well for all concerned, and in this case especially the benefit will be widespread. With decreased rates on all cables as an inevitable result of this enterprise, there will be work enough for the new company and the old cable ring as well.

Mr. Mackey, who figures so prominently in this latest undertaking, was recently interviewed regarding the future of his other scheme, the Postal Telegraph. He said this enterprise was now fairly launched, and that he did not consider Jay Gould a formidable antagonist from a business stand-

point. "He is," says Mr. Mackey, "the worst hated and most overrated man in New York. He has frightened the life out of heavy business men, and they think he can crush them out if he chooses. This is all humbug. Capital is not so powerful as people think. When a man who has kept his business as a constant menace to the public, and acted as the bully instead of the friend of his patrons, it takes very little to knock him out, provided you give his patrons to understand that you are in the fight to stay. Opposition lines have not succeeded because the people feared that they would sell out to Gould, and so, you see, they did not dare patronize the new line for fear that, after the consolidation, Gould would revenge himself and crack on the prices higher than ever. The new line has the confidence of the public, because it is not looked upon as a sell-out proposition."

A STONE BRIDGE AT MARKET ST., PHILADELPHIA.

The joint Committee of Finance, Highways and Surveys of the City Councils of Philadelphia, after a lengthy discussion, decided on Oct. 17 that the proposed Market St. bridge should be built of stone.

The arguments used in arriving at this conclusion were that nothing but a stone bridge with a roadway 100 ft. wide would meet the demands for traffic at this point; that the iron bridges upon stone foundations now spanning the Schuylkill had not given general satisfaction. The Girard Avenue bridge cost $1,486,000, is 1,000 ft. long and requires constant attention, the passing over it of only a dozen head of cattle causes extensive vibration; that the Chestnut St. bridge cost $700,000 and is now in a very unsafe condition, and demands immediate and extensive repairs to prevent its failing entirely; that the South St. bridge cost $800,000, and the Western approach across the meadows had already tumbled down; and that the Callowhill St. bridge cost $1,200,000, and is by no means the best bridge in that city.

The clinching argument with the committee seems to have been a proposition from the firm of Clark, Walsh & Co., of New York, to build a stone bridge in ten months for the sum of $900,000 to $1,100,000. This firm claims to have built the Charles River arch on the Boston Water-Works, and many of the bridges on the North Pacific, and promises to put $600,000 worth of plant upon the ground, to further the work, and give any bonds required.

According to the opinion of the City Solicitor, though the city has at present only $275,000 in hand for this work, a contract amounting to $1,000,000 can be legally entered into provided that the contracting parties will consent to take their pay "in amounts agreeable to Councils covering two, three, or more years." The new Penna. Constitution of 1874 provided that the debt of the city should not be increased beyond a certain limit, which has already been reached.

The arguments used in comparing existing bridges with the proposed structure at Market street we fear are somewhat lame. Faulty construction in the past is no guide for future work. The nature of the ground on the west bank of the Schuylkill River has been the chief trouble in the past. It is a soft ooze 40 ft. or more in depth, and the failures referred to were not due to superstructure at all, but to foundations. Stone arches will only make more certain and widespread the ruin resulting from the giving way of any one foundation. This was the case at South street, where the mistake was first made of founding nine heavy stone arches upon piles driven in this soft and uncertain substructure, and the sinking of a few piles at one end of one arch pier caused the downfall of the entire approach.

At Market street the rock lies 42 ft. below city datum, on the west bank of the river, and as the stone arches will be very flat to meet the conditions of the site, the western abutment will have to be exceedingly massive and broad of base to absorb the horizontal thrust; the river piers should also be practically abutment piers. We should like very much to see the details of the stone arch structure that it is proposed to build upon this site and of the dimensions required, for the sum of $1,000,000.

This whole affair is but another illustration of the peculiar methods which prevail in the management of municipal matters in the City of Philadelphia. A question involving some of the most intricate problems of civil engineering is decided, not by the engineering staff of the city, or by experts qualified t express an opinion, but by Councilmen, who, as in this case, "have investigated the subject of bridge building quite extensively." The very blunders to which they now refer were practically the work of their predecessors in Councils, who took upon themselves the responsibility of selecting the design. Prettily painted plans of superstructure, and an "interest" in the contract have won more than one Councilman's heart in the past.

CHICAGO PUBLIC WORKS.

The Seventh Annual Report of the Department of Public Works of Chicago has made its appearance.

The total bonded debt of the Water Department now outstanding is $3,955,000; in 1882 24,150 million gallons of water were furnished, with a revenue therefrom of $1,049,576, or $43.46 per million gallons.

18 $\frac{668}{1000}$ miles of sewer were built during the year past at a cost of $213,024.79. The total cost of maintenance of sewers, including cleaning and repairs, averaged $100.26 per mile. The total length of existing sewers is 381 miles, with 11,402 catch basins and 13,595 man-hole chambers; of these sewers 208.8 miles are of brick and 172 miles of vitrified pipe. The total cost of all sewers has been $5,888,486.96, or an average cost of $15,458.42 per mile.

During 1882 24$\frac{44}{100}$ miles of streets were made; of these 17$\frac{6}{10}$ miles were cedar blocks on plank foundations, 5¼ miles macadam, and the remainder asphalt and stone block.

The total length of city pavement is 183 miles, laid at a cost of $986,875.45, an average of $36,837.45 per mile.

Of horse railways within the corporate limits there were 78$\frac{81}{100}$ miles controlled by three companies, the Chicago West Div. Co. owning 44 miles of the system.

The report states that the superiority of stone-pavement over wood is being realized by property holders as being in the end more economical; that the era of stone pavement may be said to be inaugurated. For streets of moderately heavy or light traffic cedar block and macadam pavement, properly laid, will be entirely satisfactory, but the wooden blocks should be laid on concrete foundation instead of plank, as is now customary. The economy of concrete base comes in the repairing. To insure faithful work and good material the city now requires from the contractor, in addition to the usual guarantee, the following sums retained from the contract price: On each square yard of granite pavement, 5 cents per annum, or 20 cents for a period of five years; on asphalt blocks, 3 cents per square yard, or 15 cents for five years; on cedar blocks 3 cents per square yard for a period of two years. The streets are to be inspected at stated intervals, and at the end of each year subsequent to the completion of the work, the retained amount will be paid to the contractor less the amount, if any be necessary, to keep the pavement in thorough repair.

116$\frac{37}{100}$ miles of sidewalks were built during the year 1882, and 16$\frac{15}{100}$ miles repaired. The total existing sidewalks in the City are as follows: 697.8 miles wood, 39.4 miles stone, 9.58 miles concrete; a total of 757.28 miles.

The street cleaning since May, 1882, was done by contract for $30 per mile. The total contract miles cleaned was 1,644$\frac{55}{100}$ at a total cost of $56,058.57. The average cost of cleaning prior to the contract was $143.09 per mile.

An interesting chapter of the Report is devoted to the "Early Public Improvements" of Chicago. From it we extract the following items:

The first "road" in Chicago was located in 1831 from the Public Square to the Western county line. In April, 1832, several streets and roads were authorized, 50 ft., wide as laid out. In Aug., 1833, the town of Chicago was incorporated. By the winter of 1836 the leading thoroughfares were turnpiked; in 1844 Lake street was planked from State to Dearborn streets; this is believed to be the commencement of planking the streets. In 1849-50 nearly three miles of plank-streets were laid at a cost of $31,000. General numbering on the streets was commenced about 1848. In 1855 the first pavement of limestone blocks was laid, and in 1856 the first Nicholson or pine-block pavement was put down.

The first means established for crossing Chicago River was by a ferry established in 1829 by the Commissioners of Peoria. In 1833 a floating bridge of rough logs was thrown across the South Branch by the United States troops at Fort Dearborn. This served until 1840. The first bridge over the North Branch was built in 1832, for foot passengers only. The first draw-bridge over the main branch of the river was placed at Dearborn street in 1834, it was constructed of timber cut from land adjoining Michigan avenue.

The earliest efforts to provide a public water supply was in Nov., 1834, when the Board of Trustees paid $95.50 for digging a well in Kinzie's addition; water was early carried from the Lake in carts and sold to consumers. In Jan., 1836, the Chicago Hydraulic Co. was incorporated for a period of 70 years. Delayed by the panic of 1837, the works of the company were not fairly commenced until 1840, and they did not go into operation until the spring of 1842. At this time the company had a reservoir built and two miles of wooden pipe laid, and a 25 horse power engine pumped the water from the lake; the cost of the plant was $22,000. In Dec., 1841, the City Council contracted with the Hydraulic Co. to supply the city with water for the extinguishment of fires. In Feb., 1851, the present works were authorized by act of Legislature.

The drainage of the city until 1850 was mainly surface drainage. In the year named triangular oak sewers were constructed underground on the principal business streets, in the South Division, and in 1854 there were 4½ miles of sewers in existance of this character. In Feb., 1855, a thorough system of brick and pipe sewers was entered upon.

In 1854 levels were taken over the surface of the town and the report contains a table showing the extent to which the surface of the city has been raised since that date; we notice that throughout the South Division of the present city the grade has been raised from an average of 6 ft. above datum in 1854 to an average elevation of 14 ft. above same base in 1882.

From the Report of the City Engineer we note the daily average of water pumped in 1882 was 66,166,969 gallons, about 3½ per cent. more than the consumption of 1881. The variation between maximum and minimum daily consumption was 28,029,025 gallons. The average cost per million gallons of water pumped by both works was in 1882 $7.34; pumping against an average head of about 96 feet, with an average cost of coal of $6.16 per ton. Cost of delivering one million gallons one foot high $0.06 $\frac{26}{100}$.

Contracts have been let for an extension of the west pumping works, the addition to have a capacity of 30,000,000 gallons in 24 hours. The quality of the water has been uniformly good.

PROMOTIONS IN THE ENGINEER CORPS.—Upon the recommendation of a board of engineer officers in New York, the following promotions have been made in the engineer corps, consequent upon the death last July of Major Farquhar: Capt. MILTON B. ADAMS to be major, First Lieutenant H. S. TABER to be captain, and Second Lieutenant O. S. CROSBY to be first lieutenant.

MODERN EXPLOSIVES.

The current number of the *North American Review* contains an able article upon this subject, written by Gen. John Newton, who has had unusual opportunities of practically investigating the properties of modern explosions.

He states that according to the latest experiments, gun-powder explodes within the limits of its own volume, develops a pressure per square inch of 6,400 atmospheres, or 42 tons, and that the temperature of combustion is 3,992° Fahrenheit. This substance is composed of two combustible ingredients, charcoal and sulphur, and a third, niter (potassium nitrate) which furnishes oxygen to support the combustion. To disengage the oxygen of the nitrate and combine it with the carbon and sulphur, requires a considerable disturbing force hence gun-powder cannot be classed with the quick explosives. Sulphur inflames at a lower temperature and gives more heat than charcoal, and aids the combustion of the powder and increases the elastic pressure of the gases.

When the charge in a gun is first ignited, the flame rapidly spreads over the surface of the grains of powder, and in the first few instants of time develops a large amount of gas before the projectile has sensibly moved from its seat. This results in great strain upon the metal of the gun. With the increase in calibre, and especially in the introduction of heavy rifled ordnance, the size of the grains was increased, largely diminishing the total surface exposed to combustion; but the initial strain was still too great, and it was to decrease this that General Rodman, of the U. S. Army, first suggested what is now known as "prismatic powder;" that is, powder pressed in hexagonal cakes perforated with holes. The effect of this was to increase the surface of combustion as the projectile was moving in the bore, decrease the strain upon the gun, and permit increase of charge, and consequently greater velocity of the shot. This powder is now adopted by Russia and Germany for all heavy rifled guns. The peculiar shapes given it are to economize space in the chamber.

Gen. Newton believes that neither the use of armor nor the heaviest artillery will suffice to give the advantage to ships-of-war in combat with modern land batteries provided with torpedoes and heavy armor-piercing guns. But the introduction of long-range artillery requires such forts and batteries to be placed at a greater distance than formerly from the points they are intended to protect.

A great need in warfare is for some explosive powerful enough to burst with effect the heavy armor-piercing projectiles of the present day, so as to rend the sides of an iron-clad ship. The cavity in shot of this description is too small for gun-powder, and neither nitro-glycerine, gun-cotton, nor dynamite No. 1 could be used, owing to the danger of their explosion before leaving the gun. The new substance, gelatine dynamite, or explosive gelatine, from its remarkable indifference to shocks and itsextraordinary power, may furnish the material required.

The term "burning" is especially given to progressive combustion, as in gun powder; and the expression, "detonation," is reserved for rapid and almost instantaneous combustion, as in mercuric fulminate.

When the chemical decomposition of the materials takes place with extreme rapidity, the elasticity of the resisting mass has not time to come into play, and rocks are crushed and hollow projectiles broken into exceeding small fragments. In this manner even the atmosphere acts as a "resisting wall," and accounts for the extraordinary local effect of this class of high explosives.

Cartridges of quick explosives may be detonated at certain distances from each other by the explosion of one of them. Experiments made in 1876 at Hallett's Point showed that submerged cartridges of dynamite of one pound each, in a paper wrapper, were exploded by sympathy by the action of a similar cartridge 18 feet distant.

Mr. Berthelot explains the detonation of nitro-glycerine and gun-cotton, by a primer of mercuric fulminate, as due to the heat evolved by the primer, and to the shock of its detonation, also converted into heat, acting upon a small portion of the explosive compound, which is sufficient under existing pressure to decompose suddenly into gas the portion in contact; and the next portion receiving the violent shock of the gases, the decomposition, by repetitions of this process is almost instantaneously transmitted through the mass.

Compressed gun-cotton, wet and dry, and dynamite, laid in trains, with the disks or cartridges in contact, give the following rates when detonated at one end: For dry cotton, 17,500 ft. per second; for wet cotton, 20,000 ft.; and for dynamite, 21,600 ft. per second.

Mercuric fulminate used in the primers, when detonated within its own volume, developes a pressure of nearly 40,000 atmospheres per square inch, over 300 tons. Nitro-glycerine, dynamite, and air-dry compressed gun-cotton are exploded by the use of this fulminate. Wet gun-cotton requires a primer of the dry kind, itself detonated by the fulminate. Frozen nitro-glycerine requires a larger primer of the fulminate. Granulated dynamite in the frozen state is detonated with fulminate, but frozen in compacted cartridges requires first a primer of a soft cartridge.

Nitro-glycerine is formed by the action of a mixture of sulphuric and nitric acids upon glycerine. The compound formed is a substitution product, several atoms of hydrogen in the glycerine having been replaced by equivalents of nitric peroxide. It owes its explosive sensitiveness to the comparatively feeble union of the oxygen and nitrogen in the peroxide, and a slight disturbing cause brings into play the stronger affinity of the hydrogen and carbon for the large store of oxygen contained in the new compound. It congeals between 40° and 45° in the pure state.

Dynamite No. 1 is formed by the intimate mixture of 25 per cent. of an infusorial earth, kieselguhr, with 75 per cent. of nitro-glycerine. It congeals at 45°.

Gun-cotton is prepared from cotton fiber treated with a mixture of sulphuric and nitric acids. The fibrous gun-cotton is then very finely divided by machinery and reduced to a pulpy state in water, and finally compressed into cakes under a pressure of 4 to 6 tons per square inch. It may be safely kept for an indefinite time when saturated with water. In its combustion it gives out a poisonous inflammable gas, carbonic oxide, and hence is not suited for underground work.

Tomite, as manufactured at San Francisco, is a mixture of gun-cotton and nitrate of baryta, and is a useful blasting powder.

Explosive gelatine is formed from nitro-glycerine, 90 per cent., and 10 per cent. soluble gun-cotton, with the addition of a small percentage of camphor to render it insensible to shocks, concussion and other causes of accidental explosion. Of all combinations known and applied to practical use it is said to be the most powerful. It may be preserved intact for an indefinite time under water. It is uneffected by violent shocks and even by explosion close to it. In conclusion, Gen. Newton states that it appears that there is no agent that can supplant gunpowder for the principal requirements of warfare. In blasting rock the higher explosives generally have the advantage unless this rock is weak in cohesion, when gun-powder is preferable. In coal mines, where large blocks are required, the higher explosives are too destructive in their action and cannot be used.

Referring to the use of dynamite for unlawful purposes of assassination and destruction of property, he says it can only be applied upon a limited scale and with nearly fruitless results, as both time, money and elaborate preparations are required for effective work, and under the circumstances these could not pass without detection and suppression.

O. CHANUTE, late Chief Engineer and now Consulting Engineer of the Erie Road, was lately in St. Louis.

PERSONAL.

THE Engineering Corps of the Canon Valley road is in the vicinity of Mankota, Minn.

GEN. ADNA ANDERSON, Chief Engineer of the Northern Pacific R. R., was registered at the Everett House, this city, on the 15th.

THE Engineering Corps under W. T. TRONAH left Duluth lately for Pigeon River to survey the North Shore line of the Duluth, North Shore & Southwestern.

R. E. MCMATH, Mem. Am. Soc. C. E., has resigned his position under the Mississippi River Commission to accept the office of Sewer Commissioner, of St. Louis, Mo.

MR. JOS. L. HUNTER, C. E., arrived in Victoria, B. C., lately from Eagle Pass. He proceeded to Victoria to take charge of the new surveys for the Island railway, of which he has been appointed chief engineer.

CHIEF ENGINEER BARCLAY, of the Canadian Pacific Railroad, lately returned to Winnipeg along with Engineer TISDALE, from two weeks' employment on railway work. Mr. TISDALE will likely have charge of the survey party for another location.

WILLIAM F. SHUNK is appointed Associate Engineer of the American Construction Company to act in conjunction with Chief Engineer Robert H. Sayre; the latter gentleman still retains his position as President of the Southern Pennsylvania R. R.

COL. NORTON, the pioneer nail manufacturer, of Wheeling, W. Va., and one of the heaviest iron operators in the West, died in Wheeling Thursday night, the 11th, after a brief illness. He founded the first nail foundry of the State on what is now the site of the Baltimore & Ohio Railroad station in Wheeling in 1840, and was also one of the proprietors of the famous Belmont Mill. He was 71 years of age and immensely wealthy.

PROF. J. LAWRENCE SMITH, the scientist, died at his residence in Louisville, Ky., last week. He had been ill since August, and his death had been expected. He was born near Charleston, S. C., Dec. 16, 1818, graduated from the University of Virginia, from the Medical College of South Carolina, and in chemistry and science at the Polytechnic School in Paris. He was the inventor of the inverted microscope, which rendered unnecessary the clumsy binocular glass. Prof. SMITH served on many scientific commissions. He was very wealthy and leaves a widow.

At the International Fisheries Exhibition in London, Eng., the following have been awarded gold medals:

The United States National Museum, the United States Lighthouse Board and the United States Signal Service.

Professor J. E. HILGARD, Superintendent of the United States Coast and Geodetic Survey, Washington, for ocean salinometer and optical densometer.

Commander CHARLES D. SIGSBEE, United States Navy, for apparatus employed in deep sea research in the work of the United States Coast Survey.

WILLIAM L. BAILIE, past assistant engineer United States Navy, for self-registering thermometer for deep sea research.

PROF. J. LAWRENCE SMITH died recently at Louisville, Ky. He was a native of Charleston, S. C., born in 1818. He graduated from the University of Virginia, and selected civil engineering as his profession. He was engaged to survey a projected railroad between Charleston and Cincinnati. He studied medicine and graduated at the Medical College of South Carolina. He studied several years in Europe and was sent by President Buchanan to Turkey to teach the Turks the cultivation of cotton. He was appointed by the Turkish Government Mining Engineer for Turkey, which place he filled four years. In 1857 he invented the inverted microscope. Returning America, he was appointed Professor of Chemistry in the University of Virginia. He was a Commi

sioner to the Paris Exposition of 1867 and the Vienna Exposition of 1873. He was a member of several learned societies at home and abroad.

The many friends of Mr. HIRAM A. MILLER, the engineer in charge of the construction of the New Orleans & Mississippi road from this city to Baton Rouge, hope to see him appointed superintendent of the New Orleans & Vicksburg Division. Mr. MILLER is eminently fitted to occupy the position, for the reason that his knowledge of the levee system, and the experience he has had in building levees and closing crevasses, would enable him to cope successfully with any danger threatened by the river. Aside from this, his skill as a civil engineer would render his services valuable in keeping the road and bridges in good condition. Mr. MILLER has been engaged in railroad work for a number of years, and is thoroughly acquainted with all the details of the construction and operation departments. As he is highly esteemed by the people of this city and the planters along the river, the general impression in railroad circles is that he is the right man for the place.—*New Orleans Times-Democrat.*

EDWARD LEONARD.—The *Philadelphia Times* of the 16 Oct. says: A life of singular vicissitudes found a gloomy end yesterday in an elegantly furnished second-story room at 244 South Eleventh street. The life was that of EDWARD LEONARD, a civil engineer of large ability and apparently considerable fortune. He was found dead at two in the afternoon upon the floor of his sleeping chamber. The man had three children, the eldest a boy of about twelve. A physician accompanied the child home and found the father dead. The room in which the dead man lay was in the utmost disorder. Among the things which littered it was found the civil engineer's check-book and a book containing his account with the Tradesmen's National Bank. On a lower floor was a library, believed to be worth between $3,000 and $5,000. The dead man had done no active work for a long time. He had an interest in several valuable patents and had been fortunate in speculation. He is said to have received $60,000 within a year from various sources. The owner of the house in which he resided said yesterday that LEONARD had always paid him promptly in checks, which no bank ever hesitated to cash. The dead man did not seem to have many friends here, but said to be well connected in Baltimore.

CORRESPONDENCE.

IRRIGATION AND CURRENT MOTORS.

ALBION, Cassia County, Idaho,
Oct. 6, 1883.

EDITOR ENGINEERING NEWS:

A large river runs through a vast tract of first-class agricultural land. The climate renders irrigation necessary. The river has, in many places, rapids and falls, but runs through a strip of country above this arable land, the nature of which, the size of the river, etc., would make canal works eminently expensive. Can we get current motors that will utilize the rapids economically, and raise water in large quantities, to irrigate land by the thousand acres, as, if this cannot be done, an investment of from one to five hundred thousand dollars will be required to bring out the stream by gravity? The power of the river is immense, if it can be utilized, but we are afraid that, as we have been informed, current motors will realize but 10 or 15 per cent. Any information of this or other points in the irrigation problem would be thankfully received by this community.

Very respectfully,

FRANK RIBLETT, County Surveyor.

[The only current motor of which we have any knowledge is an *undershot* wheel carried in a floating frame, or between two scows; a curved gate conforming to the circumference of the wheel regulates the amount of water impinging on the buckets, and, consequently the speed of the wheel; the power is conveyed to the pump or other machinery on shore by a bevel-gear and a belt. We know nothing of the *duty* or work performed by this motor. In Egypt 16-inch centrifugal pumps are used, run by steam power, however. Turbine wheels, connected by gearing to power-pumps, could be used, were the falls or rapids so located as not to require the expense of dams. The quantity of water required to irrigate "thousands of acres of land" is a most important factor in any scheme that might be proposed. In Colorado the amount estimated as required for irrigating purposes is 1.44 cubic feet of water per second for the irrigation of 80 acres; or, in other words, the duty of water is taken at 55 acres per cubic foot per second. Are there no tributaries to the main stream that can be converted into storage reservoirs at a height sufficient to permit the flow of water by gravity in canals to point of utilization?—ED. ENG. NEWS.]

THE NEW ATLANTIC CABLES.

[BY CABLE TO THE HERALD.]
LONDON, Oct. 18, 1883.

Messrs. Siemens are energetically pushing the work on the new Mackey-Bennett cables, now being manufactured by them at Charlton Pier, Woolwich. They will form a duplicate line from Ireland to Nova Scotia, continued from Nova Scotia by special cable to Cape Ann, and having a branch line from Ireland to France. The work was definitely begun last week, and though materials are still being prepared and tested, yet it is already possible to determine the character of the cables.

MATERIAL OF THE CABLES.

Their core will contain a strand of eleven copper wires of the highest conductivity, weighing 350 pounds per nautical mile, and the dielectric will consist of eight coatings of gutta percha placed upon the wire according to the improved method of Messrs. Siemens, and weighing 300 pounds per nautical mile. The deep-sea portion will be covered with galvanized steel wire and Manilla hemp. All the intermediate cables are armed with steel wires. The shore ends are of the usual heavy types. Messrs. Siemens are convinced that nothing superior has ever come from their factories.

MODERN IMPROVEMENTS.

They will introduce all the improvements suggested by years of research and experience. The length of the entire system of cables will be 5,600 miles. They will be laid by the steamer Faraday in the course of next summer. A visit to the works at Woolwich shows that everything is in a forward state of preparation.

NEWS OF THE WEEK.

PARTS OF NEW ORLEANS SUPPLIED WITH WATER BY CARTS.—Owing to the existing drought, the cisterns are dry, upon which all inhabitants outside the water limits depend for a supply. Twelve water-carts, making 10 or 12 trips per day, meet the actual necessities of these districts, though there is yet a great scarcity of water for cooking and washing. People are to be seen along the Old Basin and the Claiborne St. Canal, dipping up the filthy water contained therein, to be used for household purposes.

THE Canadian Pacific survey has been completed by Major Rogers, who has struck out a direct line through the Rocky Mountains. There are three distinct passes in the Rockies proper: Kicking Horse, in the Selkirk Range; Rogers' Pass, in the Gold or Columbia Range, and Eagle Pass. This virtually settles a long-disputed question, and gives the Canadian Pacific the shortest route of all the railroads. From Winnipeg to Port Moody, on the Pacific, is only about 1,480 miles, whereas from Portland to St. Paul is 1,911 miles.

THE survey of the Wetaug, Metropolis & Paducah Railroad has been begun.

THE Tyndall Consolidated Mining Company has been organized at Milwaukee. The capital is $6,000,000.

RAILROAD CONTRACT.—The Milwaukee, Lake Shore & Western has just contracted for 1,000 tons of rail from the North Chicago Mills for further extensions north into Michigan.

ON Oct. 10 the Mississippi River Commission sent out three surveying parties to complete the topographical and hydrographical survey of the Mississippi River below Cairo. These parties are under the direction of U. S. Engineers J. A. Ockerson, C. M. Winchell and L. L. Wheeler, respectively. Each party consists of 11 assistant engineers and 45 laborers, such as rodmen, axemen, boatmen, etc.

VILLARD has arranged, it is reported, for the construction of several large steamers to operate in connection with the Northern Pacific from Superior and Duluth to Buffalo.

REVERE (Mass.) is to contract with the Revere Water Company for a supply at the cost of $3,000 per annum.

THE AMHERST (MASS.) WATER-WORKS.—These works have been greatly injured by lightning, and as they had not been accepted, the contractors, Messrs. Goodhue & Birnie, of Springfield, will have to make the repairs at their expense.

A FEASIBLE BUT EXPENSIVE PLAN.—MILWAUKEE Wis., Oct. 18.—Gen. Newton, President of the National Board of Engineers, and Col. Houston, of the United States Engineering Corps, have returned from an inspection of Wisconsin and Fox Rivers, and say they found everything in a satisfactory condition. Col. Houston says the allegation that they were to investigate frauds in Government work is entirely erroneous, and stories to that effect are disproved by the shortness of their trip, they having gone from Portage to Green Bay by boat, and having occupied only two days in the entire inspection. They looked into the project of the War Department to build a through water-way from the Mississippi River to Lake Michigan, and found the plan feasible, but one entailing great expense. Gens. Abbott and Comstock, who are also members of the board, have already inspected the work, and the board will soon meet in New York and prepare their report, to be submitted to Congress early in December. Col. Houston says the nature of their report will not be divulged till then.

THE CHICAGO, BURLINGTON & KANSAS CITY.—Ed. M. Gilchrist, civil engineer of this line, has sent orders to have all corn, etc., removed along, as work is to be begun at once.

THE BALTIMORE & OHIO EXTENSION.—There has been a failure to pay labor, etc., on this line. The explanation of the affair, as given by the B. & O. official in the office of Colonel Douglass, the engineer of the line, is that several of the creditors, having a fear of not being paid by the contractors, Messrs. Dreisbach & Wilcox, laid attachments in the hands of the treasurer of the Baltimore & Ohio Company, and thus effectually barred the contractors, for the time being at least, of the necessary funds to pay the attaching creditors or any one else. The difficulty is being arranged.

THE SOUTHERN MARYLAND.—The new company which took hold of the Southern Maryland Railroad a month or two ago has determined to shove the road to an early completion. Preparations are now being made to surface up and lay the track from Mechanicsville to Esperanza, a distance of nineteen miles.

THE ORIENTAL & INTEROCEANIC.—Capt. Wells, one of the contractors, was recently in Austin. He has 250 teams at work beyond the one hundredth mile from Laredo.

COUNTY BRIDGE BUILDING.—The Memphis *Appeal* finds fault at the number of small bridges being built, and at the agreement that seems to exist among contractors. The Big Creek District has cost $100,000 within ten years.

THE Laredo (Texas) Water-Works Company has nearly finished its contract.

THE NEW READING (PA.) RESERVOIR.—The Board of Water Commissioners held a special meeting recently, at which City Engineer Tyson presented a final estimate of the work done on the Hampden reservoir by the Nolan Bros. The estimate is as follows:

Following is the estimate of the work done by Nolan Bros. in the construction of the Hampden reservoir:

103,500 cubic yards earth at 28 cents per yard	$28,980.00
56,840 yards loose rock at 60 cents per yard	34,104.00
17,190 cubic yards puddling at 60 cents per yard	10,314 00
2,383 yards masonry at $6 per yard	14,298.00
17,780 square yards stone pitching at $1.50 per yard	17,670 00
1,546 cubic feet cut sandstone at $1.50 per foot	2,319.00
Extra work, as per account of bill	172.75
Total	$107,857.75
Less, as per settlement	1,594.56
Balance	$106,263.10
Less amount paid	86,832.73
Amount due	$19,430.46

The estimate was approved by the members of the Board present—Messrs. McHose, Holl and Jacobs, president, who ordered a warrant to be drawn fer the balance due the Nolan Bros. The bill for extras amounted to $172.75, as follows:

To 17 by 9 flagstone	$40.95
To brick work at cut-off walls	15.00
12 days' labor at test walls at $1.50 per diem	18.00
56 days' labor at drain at $1.35 per diem	75.60
1½ days' work at $5	7.50
Total	$157.05
10 per cent. for use of tools	15.70
	$172.75

LEVEE CONTRACTS.—NEW ORLEANS, Oct. 9.—Proposals were received and opened at twelve o'clock, at the office of the Board of State Engineers, on the 8th, for the following levees: Port Allen, West Baton Rouge parish—P. Harnan, 29 cents per cubic yard; J. D. Fisher, 29⅝ cents. Harnan's bid was retained and submitted to the Governor, with the indorsement from the Board that the bid was somewhat higher than they had any reason to expect.

Medora, Iberville, right bank—P. Harnan, 28 cents per cubic yard. The board took the same action on this bid as on the preceding one.

Mayflower, right bank, parish of Iberville—P.

Ryan, 23¾ cents per cubic yard; P. Harnan. 27½; J. D. Fisher, 32½. Ryan's bid was retained and recommended for acceptance

Spicer Jones, Assumption parish, right bank—P. Harnan, 25 cents per cubic yard. Retained and recommended for acceptance.

Truxillo, Assumption parish, left bank, and Jamestown, St. James parish, right bank—No bids were received for the work on these levees, and they will be readvertised.

Sarpy, St. Charles parish, left bank—Leon Sarpy, 22½ cents per cubic yard; James Crahan, 21½. Crahan's bid was retained and recommended for acceptance.

Greenwood, parish of Plaquemines, left bank—E. L. Nathrop, 20 cents per cubic yard; Hardamann & McNamara, 24 cents; Wm. Dowling, 22 cents. The bid of E. L. Nathrop was retained and recommended for acceptance.

Cantrelle, St. James parish, right bank—P. Ryan, 22¾ cents per cubic yard; C. W. Dowling, 21; W. B. McGarry & Co., 21½; J. F. Henderson, 21. There being a tie between Dowling and Henderson, and their bids being the lowest, both were retained and referred to the Governor, to be awarded by him.

Story, parish of St. Bernard—Hampden Story, 20 cents per cubic yard. Recommended for acceptance.

St. Bernard, parish of Lafourche, right bank—Claudet Bros. and Hardamann & McNamara, 20 cents per cubic yard each. Claudet Bros. withdrawing in favor of Hardamann & McNamara, their bid was retained and recommended for acceptance.

Lafourche, parish of Lafourche, left bank—Hardamann & McNamara, 23½ cents per cubic yard. Retained and recommended for acceptance.

DANGER IN ELECTRIC LIGHTING.—Another instance of death resulting from contact with electric wire occurred at Dayton, Ohio. The city is lighted by the Fuller system, which suspends the lamps at the intersection of the streets. While President Chandler, of the National Fuller Electric Light Company; President Lowes, of the Dayton Company, and Superintendent T. R. Robbins, also of the Dayton Company, were making a tour of inspection in the rain on the night of the 12th, a lamp in the business center of the city went out. Superintendent Robbins, in lowering the lamp to examine it, took hold of the conducting wire where the insulation was worn off and fell as if shot. Before he died, which was three minutes later, he said "The life is burned out of me." Had the ground been dry or insulation more complete he would have escaped.

THE NEW YORK, TEXAS & MEXICAN.—It is reported that J. W. Mackey has obtained a large interest in this line and will build it on to Mexico.

THE Burlington & Quincy is building a line from Odell to Salina (Kan.).

BRIDGE WAREHOUSES.—The contractors for putting up the stone arches under the Bridge are busy with the work, and according to contract they are to be completed by January 1 next. The Keystone Bridge Company have charge of the iron and steel work in the completion of the warehouses, and will receive $79,094.27 for it. The masonry, carpenter and plumbing work will cost $177.775.

RUST & COOLIDGE, of Chicago, have taken a contract for the bridge over the Menominee River, in Wisconsin, on the Marinette Branch of the Milwaukee and Northern road.

CLARKE, REEVES & CO., of Phœnixville, have taken the contract to build a new iron bridge over the Schuylkill River, near Reading, for the Wilmington and Northern road. It will take the place of the old wooden bridge now in use, and will cost about $45,000.

A WATER FAMINE IN WATERBURY.—WATERBURY, Conn., Oct. 18.—This city is threatened with a serious water famine. One reservoir is empty, another contains only six feet of water, while the third is ten inches below high-water mark. The Commissioners recently forbade the use of garden hose and street-sprinklers. To-day they restricted he factories, and say it may be necessary to cut he m off entirely.

WATERBURY (CONN.) WATER SUPPLY.—If what the Water Board says in public notices is true, and there is no reason to doubt it, the time is near at hand when steps must of necessity be taken for a new and larger supply of water. There is likely to be no permanent increase of supply from present resources. The demand, on the other hand, is very rapidly increasing. A well-founded opinion prevails that in two or three years at the furthest the city authorities will have to adopt some new plan for a water supply. This of course means a resort to Litchfield or Quassapaug lakes.

THE ST. PAUL, M. & M. ROAD EXTENDING ITS LINES INTO MANITOBA.—MINNEAPOLIS, Minn., Oct. 9.—A special to the *Tribune* says: The General Manager, Manvel, of the St. Paul, Minneapolis & Manitoba Railway, Col. Smith, Mr. Sawyer and Gen. Hammond arrived in Winnipeg yesterday morning, and with the local directors held a meeting with the board of the old Manitoba Southwestern Colonization Company, arranged for the transfer of that road to the new owners, who are said to be identified with the Canadian Pacific. Vice-President Ayres and General Manager Vanhorne, of the latter road, were also present, and a final sale and transfer will be made at once. The terms of the sale are unknown. Orders have been issued, however, to make a survey for the extension line to Sawisch, a distance of three hundred and twelve miles from Winnipeg. The land grant of 6,400 acres per mile does not accompany the transfer of the road.

A NEW BRANCH FOR THE ILLINOIS CENTRAL.—Cairo, Ill., Oct. 9.—The survey of the route from Metropolis to Paducah began yesterday, under the supervision of the Illinois Central officials, and is a continuation of the survey of the Chicago, Wetang, Metropolis & Paducah Railroad. The line has been in contemplation a long time, but has dragged. It is understood the Illinois Central people have taken the matter in hand, and will push it forward rapidly.

THE Jefferson Water-Works, Jefferson, Cook County, Ill.; capital stock, $1,000,000; corporators, N. Jacobson, H. G. Brigham and others; incorporated on the 14th.

THE ST. LOUIS RIVER BRIDGE.—It is reported from Duluth that Northern Pacific officials have recently informed several citizens of that city that the long-talked-of bridge across the St. Louis River, between Rice's Point, Duluth, and Conner's Point, Superior, will be built this winter. The bridge is to cost about $275,000, and if the citizens of Duluth and Superior want a wagon road across the river, they can have one in connection with the railroad bridge by subscribing a liberal sum toward the structure. The bridge will be built by the Northern Pacific Company, but the Omaha is said to have secured the right of running trains into Duluth over it.

RAILROAD ACCIDENT IN MEXICO.—CITY OF MEXICO, Oct. 15.—On Sunday, the two-span bridge on the Central Railroad, near Aguas Calientes, fell, carrying with it a construction train of 18 cars and 2 engines. Engineers Dileury and Hopkins and three Mexicans were killed. The train was completely wrecked. The delay to construction work will be slight.

ESTIMATES have been made which indicate that during the present year 946 miles of road will be built by the Canada Pacific Railway. This, it is said, will make a record without parallel in the history of railroad building.

CONSTRUCTION is progressing rapidly on the Louisville, New Orleans & Texas road. Most of the road bed is completed; 178 miles of track have been laid, leaving 275 miles unfinished, and a large portion of the rolling stock has been received.

CINCINNATI *Enquirer*, 7th: Major D. L. Sublett, Assistant Engineer of the Kentucky River improvement, reports the completion of dam No. 4 on the Kentucky River, just below Frankfort. The first timber was laid July 23, and the last sheeting was put on yesterday. The dam is 528 ft. long at the crown, 21½ ft. high and 34 ft. wide. It contains about 40,000 lineal ft. of timber, 100,000 ft. of sheeting, 5,981 cubic yards of riprap stone and 16,000 lbs. of iron and spikes, and cost the Government $18,500.

MEMPHIS *Appeal*, 8TH.—The construction of mattresses has been continued during the past ten days by Major Miller, above Hopefield, and 664 by 140 feet of mattress was constructed and 1,032 by 140 feet of mattress sunk. Heretofore the mattresses have all been straight. The one sunk during the ten days was curved so as to conform to the outline of the bank. The mat was sunk without any accident, and 490 by 40 feet upper bank revetment was made. During the ten days the hydraulic grader graded 655 lineal feet, or 4,105 cubic yards of earth, at a cost of 22½ cents per lineal foot or 3¼ cents per cubic yard. The work was considerably delayed by a thick stratum of blue clay, overlying sand, which was very hard to cut. The snagboat John R. Meigs has been employed in removing snags and accomplished the following work: Eighty-nine snags removed and two rack heaps broken up.

MESSRS. ROGERS & BALLENTINE say that they will complete all their contract work on the New Orleans and Mississippi Valley by Nov. 1. They are now engaged ballasting track and finishing all the small bridges between this city and Baton Rouge. A construction train was put on recently which will make regular trips over the road, hauling the necessary material.

STORM KING BRIDGE COMPANY.—The Board of Directors of the Storm King Bridge Railroad Company organized on the 13th by the election of Charles E. Hill, of Stamford, Conn., as President; Sidney P. Nichols, Vice-President; Augustus T. Dockarty, Treasurer; Charles H. Swan, Secretary and General Manager. The banking house of William Pollock was designated as financial agent of the company. A 10 per cent. call was made upon subscriptions. It is the intention of the company to proceed at an early day toward securing the right of way, preliminary to building this link between the West and the coal fields.

THE Union Steel Company was incorporated at Chicago, Oct. 16, with a capital stock of $4,600,000. This company is organized to purchase the plant of the Union Iron and Steel Company. The plan is that the creditors will take fifty cents on the dollar in cash or preferred stock in the new company. All the creditors have agreed to this with the exception of those holding about $60,000 of the $2,821,000 of old indebtedness. The date for the resumption of work at the mills is still very indefinite.

WASHINGTON WATER SUPPLY.—Gov. Butler, as attorney for the Great Falls Manufacturing Company, has filed in the Department of Justice a claim for $1,000,000 damages for property and water rights which will be used by the Government in effecting the proposed extension of the water supply for the District of Columbia. It is said that the whole water power and a great part of Conn's Island will be used in making the extension.

THE BALTIMORE NEW POST-OFFICE.—The revised plans are now ready for examination; they involve additional outlay of from $50,000 to $75,000.

THE contract for building the Ottawa, Osage City & Council Grove Railway in Kansas has been given to Mr. C. C. P. Holden, of Chicago. The *Inter-Ocean* says: "Mr. Holden's well-known ability and energy in this direction gives the enterprise a promise of speedy completion. For eighteen years he was connected with the Illinois Central Railroad Company, and was intimately associated with the deepening of the Illinois and Michigan Canal. For twelve years he was a member of the Chicago Common Council, and is the father of the water system of the West Side, being at the same time connected in the memory of our citizens with the public improvements of Chicago. He was chairman of the Board of County Commissioners, and had the direct supervision of the erection of the new Court House. it being largely due to the energy of Mr. Holden that the building was completed in so rapid and substantial a manner. His Kansas enterprise is a large one, and will require his immediate attention for the next two years, by which time he hopes to have it completed, thereby connecting the Missouri Pacific Railway system with the greatest corn-growing and coal producing counties of Kansas."

A MACADAM RING is in force at St. Louis. $93,000 has so far been expended for macadam.

THE WISCONSIN RIVER IMPROVEMENT.—Gen. Newton is going to examine into the merits of the Fox and Wisconsin rivers as a new route between the great lakes and the Mississippi. There is great opposition to any further work.

THE Barnesville Bridge (Conn.) is to be begun immediately.

THE Yazoo & Mississippi Valley Company has bought a large extent of river front in Yazoo City.

WESTMINSTER (MD.) WATER-WORKS.—These works have lately been completed by Col. W. W. Taylor. This gentleman is also going to build works at Havre de Grâce. The works cost $30,000.

BEGINNING A NEW LINE.—On the 8th instant, the first dirt was thrown upon the line of the new Jacksonville and Atlantic Railroad by Messrs. Genovar and Mickler, contractors.

THE Toledo government building will be begun at once, by Davidson & Marshall of Washington, D. C., the contractors.

ROCHESTER WATER-WORKS.—Rochester, N. Y., Oct. 17.—Suit was brought to-day against the city of Rochester by 20 millers residing in the towns of Honeoye Falls and West Bloomfield for damages aggregating $205,000. The plaintiffs claim that they were damaged by the construction of the water-works of the city and by the consumption by the city of waters from Hemlock and Canadice Lakes. It is alleged that since January, 1876, the city unlawfully diverted the waters of these lakes to an extent of 9,000,000 gallons daily from the mills of the plaintiffs, thereby compelling them to obtain other power to operate their mills or be deprived of profits enjoyed by them in former times. It is understood that one or more similar actions, but for lesser amounts, will soon be brought. The attorney for the plaintiffs recently carried a case against the city similar to these to the Court of Appeals and won it. He proposes to do the same with these cases, unless a compromise be made.

THE CHERRY STREET BRIDGE, TOLEDO.—There were 14 bids for the stone work and 16 for the superstructure.

FOUR PHILADELPHIA BRIDGES.—Only one bid was put in for the construction of four iron bridges, viz.: that of William L. Ziegler, who offered to build the Second street bridge for $12,000. The

Pennsylvania R. R. Co. will pay half the cost of the bridges.

THE sewers at Fort Worth (Tex.) are finished at a cost of $55,000.

DREDGING VICKSBURG HARBOR.—The contract with Capt. Rittenhouse Moore for the dredging of the harbor, which expired on the 30th of September, will not be extended. This is not an abandonment of the plan for the restoration of the harbor.

THE WATER-WORKS of Cleburne (Tex.) will be built by the Texas Water & Gas Company, of Tyler.

LOUISVILLE SEWER CONTRACTS.—Bids were opened a few days ago and contracts let to construct a mile and a half of gutters in the eastern and western districts of the city. The prices per lineal foot varied from eighty-two cents to $1. The successful bidders were H. H. Meyers, T. Mulligan, W. F. Shanks and C. Knobloch.

DENISON (Tex.) wants the Holly system of water-works.

BIDS FOR FORT WORTH (TEX.) JAIL.—The following are among the bidders: Lee Slaughter, M. J. Tenny, Waco; A. Brownlee, Dallas; Heck & Baker, Jones & Cowan, Fort Worth; Fred. J. Meyers Manufacturing Company, Covington, Ky.; E. J. Heiner, architect, Houston; J. J. Ligon, of Palestine, representing Pauly & Bro., St. Louis, but no decision was made. The contractors are loud in their condemnation of such treatment, and several of them say that they will not waste further time on the matter.

WATER-WORKS CONTRACT.—The City Council of Terrell (Tex.) has closed contract with W. C. Connor, of Dallas, to build water-works in Terrell, paying $4,000 per annum for forty-five hydrants, for a term of twenty-five years, Mr. Connor to have all income from private consumers. Work to commence in three months.

A verdict has been given for H. A. Ramsay & Co., of Baltimore, for $13,000 against the city of Richmond for the construction of the water-works in that city.

EXTENSION OF THE KENTUCKY UNION.—Lexington, Ky., Oct. 12.—To-day, at a meeting of the directors of the Kentucky Union Railway, it was decided to build immediately a road from Winchester to the mouth of "Troublesome Creek," a distance of 68 miles, and to issue bonds of the road for $2,500,000.

THE contract for building the great elevator at the Weehawken terminus of the New York, West Shore & Buffalo has been given to Baumann & Lotz, of Chicago.

NEW ROAD BETWEEN KANSAS CITY AND CHICAGO.—A corps of engineers arrived lately at Kirksville, Mo., to survey what is supposed an extension of the Atchison, Topeka & Santa Fe. This will be the second line surveyed this year from Kansas City to Chicago, and another line will be surveyed yet this fall from Hannibal, Mo., to Humiston, Ia., being an extension of the Hannibal & St. Joseph Short Line.

THE TRANS-PENINSULAR.—D. C. Hudson and Chas. Powell have begun surveys on the Washington & Atlantic. Mr. John S. Mapes has also arrived at Denton.

BRIDGE CLOSED.—The bridge over the Mohawk, between Cohoes and Waterford, has been closed as unsafe.

NEW WATER COMPANY.—The San Antonio Water Company with a capital of $500,000, has been chartered.

WORK on the Junction & East End is progressing rapidly. One of the piers between Pittsburgh & Herr's Island is completed. Engineer Roberts, of the Pittsburgh East End road, states that one-fourth of a mile of grading has been completed on the Squirrel Hill Branch.

THE CHICAGO EXTERIOR BREAKWATER.—Two more cribs are ready to be sunk. The structure has been extended 800 feet during the season. The dredges will excavate to a uniform depth of 16 feet.

MINNEAPOLIS refuses to grant a gas franchise to Messrs. Smith & Billings.

MINNEAPOLIS WATER-WORKS.—City Engineer Waters made a report that Strethman & Brooks had completed their contract for the construction of the new 10,000,000 gallon pump, and were entitled to $1,455 on the full price for the same, viz., $9,700.

OBJECTIONS TO RIVER IMPROVEMENTS.—NEW ORLEANS, La., Oct. 11.—A rule issued yesterday from the District Court at Alexandria, ordering Mr. Dougherty, the contractor engaged by Capt. Miller, United States Engineer in charge of the improvements for protecting the river-front at Alexandria, to show cause why the work should not be stopped by injunction. The petition is made by Capt. Boardman, of the Red River & Coast-Line Transportation Company. The complaint alleges that the filling up of the present narrow channel at the lower falls before providing another passageway for the boats, is inflicting upon business an irreparable injury. Engineer Beman asked that the trial be postponed until to-day, so that he could obtain instructions from his superior officers. Mayor McGernsey, of Alexandria, joins issue and furnishes able attorneys. Engineer Beman gives as his reasons for putting a wing dam on the Alexandria side of the old Bailey Dam, that he is obliged to partially throw the current to the other side, in order to protect the breakwater which he intends building at the point just below the mouth of Bayou Rapides, or it would otherwise wash away. The programme is one laid down by the Mississippi River Commission.

THE CAPE COD CANAL.—SANDWICH, Mass., Oct. 11.—Five hundred people and two bands tendered a reception to George H. Titcomb, Chief Engineer of the Cape Cod Ship Canal, last night, in appreciation of labors in negotiating the contract to build a canal and endeavoring to place in the State Treasurer's hands $200,000 as a guarantee of good faith.

THE ST. LOUIS MARINE HOSPITAL.—The contractors for the Marine Hospital wards have commenced active operations, employing about 100 men.

FARMERS FALLS, Mass., wants a system of sewerage, and Engineer Bowdich, of Boston, has been examining the locality.

DAKOTA & GREAT SOUTHERN CONTRACTS.—J. A. Voak & Co. have begun their 25-mile contract. Foley Bros., of Chicago, have a contract for 26 miles of road-bed. It would seem that the engineers left out Sioux Falls in the cold.

ALBUQUERQUE'S NARROW-GAUGE ROADS.—Albuquerque, N. M., is projecting a system of narrow-gauge roads, viz.:

1. Albuquerque & Silver City Railroad, running from Albuquerque to Silver City.
2. A line from Albuquerque to Salt Lake.
3. The Albuquerque, Copper City & Colorado, due north from Albuquerque, through Copper City, to a junction with the Denver & Rio Grande.
4. The Albuquerque, White Oaks & Pecos Valley, running due southeast from Albuquerque to the Pecos River.
5. A curved line from Albuquerque to Cerillos on the Atchison, Topeka & Santa Fé.

THE Baltimore & Ohio Railway earned in August $1,927,000, and in September $1,903,000. At the last meeting Mr. Garrett announced that while abroad arrangements were made for a regular weekly line of first-class steamships between Baltimore and Liverpool.

THE ROCHESTER & PITTSBURGH was carefully inspected a little time ago by Thomas W. Spencer, engineer of the State Railroad Commissioners.

IMPROVING AT KAWBEND.—The situation of the river at Kansas City is such as to require immediate attention. Some $200,000 will be requisite for the work.

NEW LINES INTO KANSAS CITY.—Kansas City, Springfield & Memphis opened Oct. 15; Chicago, Rock Island & Kansas City, proposed short line from Chicago to Kansas City via New Boston, Ill., and Chillicothe, Mo.; Kansas City & Des Moines (proposed); Gulf, Colorado & Santa Fé, from Galveston to Kansas City, completed to Fort Worth, Texas; Vanderbilt line through Central Missouri from Kansas City to St. Louis; San Antonio, San Angela, Colorado & Santa Fé, from San Antonio, Texas, through western Texas to Kansas City, Chicago, Milwaukee and St. Paul. This is an incomplete list of partially completed or proposed lines.

A NEW ROAD IN MONTANA.—The Bitter Root Valley Railway, from Missoula to Salmon City, Idaho, has been incorporated at Helena, Mont.

MONTANA.—A stampede has begun to the Cœur d'Alene Mountains, caused by stories of immense finds of gold, it being reported that men now working there are taking out from $20 to $100 per day, gold nuggets having been found worth as high as $48.50.

GENESEO (ILL.) WATER-WORKS.—The Chicago, Rock Island & Pacific Railroad authorities will soon make the above city a proposition to furnish it with water from Green River. The supply of water is now furnished from a deep well, and is too hard for boiler use, and inadequate to the demands. The water from the river would only be fit for boiler use and fire purposes, as the river becomes foul in dry weather.

CHICAGO CONTRACTS.—The Commissioner of Public Works on the 8th opened bids for building an extension to the West Side Pumping-works. The lowest bidders for painting and glazing were Manning & Phillips, who offered to do the work for $575. The Central Bridge Company, of Buffalo, were the lowest at their bid of $13,500 for the iron work. Joseph Downey was the lowest on the masonry, cut-stone and carpenter work, offering to perform them for $13,923.

THE DURHAM (CONN.) AQUEDUCT CO. are to relay the balance of their pipe to the Cold Springs. Hunting & Co., of Middletown, have the contract. This is one of the oldest companies in the State, having been in operation with wooden pipes before the present century. The spring is on the top of Long Hill, in Middletown, and supplies over forty families with perfectly pure cold water.

MERIDEN, CONN., has voted to build a new high-school building, not to cost more than $50,000.

IRON, METAL AND COAL MARKET.

PHILADELPHIA, OCT. 19.

Transactions footing up between 5,000 and 6,000 tons of forge iron have been closed this week at prices ranging from $17.50 to $18.50. Holders are refusing to yield as much as a week ago, and buyers are anxious to cover requirements. It has just transpired that large buyers have bought large lots at $18. In consequence of this, there is a better tone in the market, and stronger probalities of a more active demand. Foundry irons are neglected, and continue to sell at $19 to $22 for Nos. 1 & 2, with an average of $19.50 and $21; Nothing has been done in Bessemer, and some offers have been withdrawn. Finished iron met with more inquiry this week, and better sales. More sold at 2 c. than last week, and it seems as though 2 c. to 3.10 will be the ruling price hereafter, for ordinary makes. The worst has been passed and a better demand is now at hand. Old rails have not sold, and will not, until sellers drop 50c. Present asking prices for Tees, $23.50; American, $24.50; Double Heads, $26; Crop Ends, $23.25; Steel Rails are quiet this week at $37 to $38. A few blocks have been placed. Inside prices for nails, $2.85;

PITTSBURGH.

To-day's selling prices for iron and steel are $20@$21 for No. 1; $18@$19.50 for No. 2; $20.50 cash for Bessemer, $21 on time; Gray Forge, $17.50@$18.50; Steel Rails, winter delivery, $37; November and December delivery, $38; old T Rails, $24; Scrap, $22.50; Merchant Bar, 1.80@1.90c.; Nails, $2.70@$2.80. The local furnaces have sold out the bulk of their stock, and a better demand is at hand. Nine out of twelve furnaces are at work, The situation in the glass trade is unchanged. The steel mills are distributing their entire product at weak but steady prices. The coal trade is active, and heavy shipments by railroad are in progress.

CHICAGO.

A slight improvement has developed in the Northwestern iron market, and concessions are less frequently heard of. Fall demand is coming in more freely. Pig iron continues to improve, and covers all grades. Lake Superior Charcoal, $23@$25.50 for Nos. 1 to 6; Ohio Irons, $22@$23.50; Pennsylvania Irons, Thomas, $24.50@$26.50; Crane, $23.50@$25, for Nos. 2 and 1. Alabama Coke, $2. Production of ore so far this year, 1,766,103 tons; same time last year, 2,321,116 tons, showing 555,013 tons less than last year. A further decline in ore is probable on account of the accumulations in the Lake Superior region and at shipping points. Steel Rails are weak at $40, and mills are running short of orders. The market is quiet for merchant steel. Lake Copper quiet at 15¼c. Nails, $2.90@$3 in carload lots. Merchant Bars are strong at 2.05@2.15c. Structural iron is moving slowly. Stocks of foreign sheet iron are light.

COAL.

The managers of the anthracite coal trade are less satisfied with the present condition of that industry than a month ago. Consumers' requirements are less urgent. The active demand has slightly fallen off. Inferior coals, outside of the Schuylkill and Lehigh regions, are being offered at concessions. The question of suspension is being seriously considered. One great drawback to firm prices is the dullness of demand in the local manufacturing interests. On October first of last year 72 anthracite furnaces were idle; now the idle number has reached 115,43 more. This serious decline in output is felt by the coal trade. The decline in demand for mill purposes is also a trouble. The domestic demand is active enough, and the decline in local requirements is partly compensated for by an increased Eastern, Western and Southern demand. Facilities for production have been increased, and this fact makes it necessary to consider the question of restricting output. The policy will be resorted to, unless demand should improve. The production will average 740,000 tons per week. The Reading company mined 312,000 tons last week. The production reported is 24,200,000 tons; the output of bituminous coal shipped to eastern markets is for week 114,000; Cumberland output 57,418, for year, 1,918,771 tons.

The coke trade is improving in activity, and prices are firm at $1 to $1.10, at ovens. The competing railroads have not yet decided the question of distribution of traffic. The Tyrone and Clearfield Railroad carried last week 60,041 tons of coal. The Reading shipped 20,953 tons west. Several strikes exist in Western Pennsylvania, and will help to arrest the declining tendency in soft coal.